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COÖPERATION BETWEEN ACADEMIC AND OFFICIAL STATISTICIANS.*

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After I had gladly accepted the invitation to address you this morning on the subject of coöperation between academic and official statisticians, I was requested to represent the Royal Statistical Society on this anniversary occasion and to convey to you their appreciation of your work in the past and their good wishes for your future. This naturally led me to consider the original connection between the British and the American societies with the idea of making it at least an introduction to my main theme. But the circumstances surrounding the birth of the British society are so little known on this side of the Atlantic and so significant in their bearing upon the origin of our own association that I have decided to state them in detail even at the cost of abbreviating what at first I had planned to say. The two themes are not so unrelated as might at first appear, because in my opinion it is or should be the main function of a statistical society to foster coöperation between academic and governmental statisticians.

The formation of the American Statistical Association was one result of a general interest in the establishment of statistical societies which reached its climax between 1830 and 1840 and may be traced in France, Germany, Italy, and the United States, but was nowhere so strong as in England, where special conditions gave it a notable development. In that country the British Association for the Advancement of Science had been formed in 1831, and two years later it had constituted a statistical section; in the same year, 1833, the Manchester Statistical Society was organized; in 1834 the Statistical Society of London, now the Royal Statistical

*Address at the Seventy-fifth Anniversary Meeting of the American Statistical Association, Boston, Mass., February 14, 1914.

Society, was founded; and before 1840 similar bodies had been established in Bristol, Glasgow, Liverpool, Belfast, Birmingham, Boston, and possibly New York. All of these associations had similar objects and a similar organization and sprang from a common impulse. Most of them had an ephemeral life; only three of them are still active, two of which, the Royal Statistical Society and the American Statistical Association, are the oldest national statistical societies in the world.

The development of English statistics has been closely associated with the English Royal Society, the greatest of all scientific associations past or present and the cradle of modern statistics. During the last half of the seventeenth century and the first forty years of its life, the work of three Fellows of the Royal Society, John Graunt, William Petty, and Edmund Halley, laid the foundations of that political arithmetic which was later with comparatively little change of content to be rechristened with the German name *statistics*.

Shortly before the societies with which we are now concerned were founded, the Royal Society fell for a time upon evil days, dissensions within and attacks without. Grave accusations against the administration were published but led to no investigation.* Two parties developed in the society and came to a trial of numerical strength at the election of 1830, when the reforming element supported for the presidency the great mathematician and astronomer, John Herschel, and the conservative element supported the Duke of Sussex. After great interest had developed and an unprecedented number of votes had been cast, the election resulted by a very narrow margin in favor of the conservative candidate, the Duke of Sussex.

Among Herschel's ardent supporters was Charles Babbage, who was more responsible perhaps than any other Englishman for the foundation of the Statistical Society of London. In a book, *On the Decline of Science in England*, published in 1830, Babbage had strongly criticised the constitution of the Royal Society, and at about the same time another member of the reforming party, David Brewster, suggested "an asso-

*"The Society (sc. The Royal Society) has for years been managed by a *party* or *coterie*. . . . The great object of this, as of all other parties, has been to maintain itself in power, and to divide, so far as it could, all the good things amongst its members." Charles Babbage, *Reflections on the Decline of Science in England* (London, 1830), p. 141.

ciation of our nobility, clergy, gentry and philosophers" on a more democratic basis. A year after the defeat of the reforming element in the Royal Society, this suggestion of Brewster's bore fruit in the organization of the British Association for the Advancement of Science. It was avowedly an imitation of the Society of German Naturalists and Physicians, which had been formed in 1822 in execution of a suggestion from Oken and which a few years later had gained great prestige from the judicious support of the kings of Bavaria and Prussia and the reputation of its president, the most distinguished of living scientists, Alexander von Humboldt. No doubt the spirit of reform which found expression in the continental revolutions of 1830 and the English reform bill of 1832 was a potent influence in support of the new movement out of which the British Association sprang.

Another factor contributed directly and powerfully to the early recognition of statistics by the British Association. During the decade of which I am speaking Quetelet was probably the most widely known and was rapidly becoming the most distinguished of living statisticians. He had published his first essay in this field in 1826 and in various papers printed during the following years he had shown the regularity with which crimes occurred in different areas and recurred in successive years, and had thus laid the basis not only for what is sometimes called moral statistics, but also for that general view of social life and action which at first he called social mechanics and later social physics. In 1833 Quetelet went to England to attend the Cambridge meeting of the British Association* and carried with him a budget of statistical facts for which the organization of the meeting could provide no place.† This difficulty led his friend, Charles Babbage, one of the three trustees of the new Association, to suggest the formation of a new section on statistics, and one was hastily improvised with Babbage as chairman but without the usual authorization of the Central Committee. In explanation of this procedure, the president of the Association‡

*British Association, *Reports*, III (1833), 484.

†Wm. Farr in *Journal of the Statistical Society*, XXXIV, (1871) 412.

‡Rev. Adam Sedgwick, professor of geology at Cambridge University, and not William Whewell, as one authority has it.

in his concluding address said that, in addition to the regular five sections, "another had come into operation, the object of which was to promote *statistical* inquiries. It had originated with some distinguished philosophers, but could not be regarded as a legitimate branch of the Association till it had received the recognition of the governing body; there could be little doubt, however, that the new Section would obtain the sanction of the General Committee with some limitation perhaps of the specific objects of inquiry."* The sanction and the limitation thus foreshadowed found expression when the General Committee approved the formation of a Statistical Section and resolved "that the inquiries of this Section should be restricted to those classes of facts relating to communities of men *which are capable of being expressed by numbers, and which promise, when sufficiently multiplied, to indicate general laws.*"†

This limitation was apparently designed to prevent the statistical section from being led astray into the speculations of economics and the controversies of politics.‡ It was a direct, although probably an unintentioned challenge of Quetelet's opinion. Four years before he had written: "Among the data of statistics are some which can be expressed in figures and others which cannot. To use only one of these kinds of data is to see only one side of statistics."§ Naturally enough, Quetelet considered that the resolution of the General Committee took "too limited a view of the functions and objects of statistical inquiry"|| and he suggested to Babbage the organization of a separate statistical society. The suggestion was adopted and the Statistical Society of London formed in 1834.¶

*British Assn., *Reports*, III (1833), xxviii.

†British Assn., *Reports*, III (1833), XXXVII. The italics are in the original.

‡Intern. Stat. Institute, *Bulletin*, I, pts. i and ii, (1886) 41.

§A. Quetelet, *Recherches statistiques sur le royaume des Pays-Bas*, (1829), Introduction, p. iv, in *Mémoires de l'Académie de Belgique*, V. Compare Quetelet's definition of statistics, "The representation of a State at a given point of time," quoted in Royal Stat. Soc., *Journal*, Jubilee vol., 8.

||Mouat, in Royal Stat. Soc., *Journal*, Jubilee vol., 15.

¶Fifty years later the same antagonism of opinion regarding the scope of statistics was still acute. At the Jubilee meeting held to commemorate the fiftieth anniversary of the founding of the Statistical Society of London, the president in his opening address proposed as a definition of statistics "the science which treats of the structure of human society" and rejected the narrower definition "the science of social facts expressed in numbers." *Idem*, 8.

At the same period and as a result of the same movement, initial steps were taken towards organizing at least two American statistical societies, the New York Statistical Society and the American Statistical Association. The New York society was the earlier, having been incorporated in 1836 and its charter amended in 1839. It was frankly modelled upon the Statistical Society of London.* Its original charter provided for a capital stock of $50,000 and that the society should commence operations when the full amount had been subscribed and $5,000 paid in. Three years later the act was amended by allowing the society to commence operations immediately, but I have found no record that it did so.

The beginnings of the American Statistical Association are shrouded in obscurity. No direct connection between it and the Statistical Society of London has been demonstrated. At the meeting of this Association six years ago President Wright said: Whether the founding of the Statistical Society of London "inspired the organization of this Association, I cannot say but it is safe to assume that this was the case."† That judgment seems to me warranted by the evidence. The sequence in time, the similarity in name and in form of organization, the use by our society at the start of the English term *Fellow* instead of the then usual American term *member* are straws suggesting but in no wise proving the connection. In its Annual Report made in 1842 the Council of the Statistical Society of London wrote: "The Council . . . are much gratified in stating that the Constitution of the Society has served as a model for the American Statistical Association which has been established at Boston, United States."‡ Perhaps stronger evidence in favor of that conclusion may be found in the statement regarding our Association's field and aim which it published in 1840 and republished three years later as the preface to the first volume of its *Collections*. The opening and the closing sentences of that statement are quo-

*"In the important city of New York a Statistical Society has been appointed and established by the Legislature of that State; and the Council feel gratified in reporting that the principles and regulations which form its Constitution have been avowedly adopted from those of the Statistical Society of London." Stat. Soc. of London, *Journal*, I (1838), 8. See also, Silliman's *Am. Journal of Science and Arts*, XXXII (1837), 202. New York Laws 1836: Chap. 495, and 1839: Chap. 193.

†Am. Stat. Assn., *Quart. Pub.*, XI (1908–09), 1.

‡Stat. Soc., *Journal*, V (1842), 89.

tations from the first few pages of the first volume of the *Journal of the Statistical Society of London* and yet to the careless reader that fact would not be apparent. No quotation marks are used about the first sentence and only an indefinite reference is given in the footnote. Although quotation marks are used about the last sentence, no other reference to the source is made than the introductory words, "In the language of a kindred institution." Can the writer have thought it inadvisable to emphasize the extent of his obligation to an English society?

However that may be, the "Address put forth by the Association at the period of its first establishment in the year 1840" differs in one important respect from the corresponding statements in the *Journal of the Statistical Society of London.* It draws heavily upon some unidentified German source for facts regarding the history of statistics in Germany and Sweden, and the position of that subject at the time our Association was organized not only in those countries but also in France and Italy, and it intersperses brief references to the main writers on statistics. The German cast of this part of the "Address" and its seemingly deliberate omission of any reference to the English writers on Political Arithmetic, who were mentioned by its English predecessor, show that the writer regarded the statistics which our society was to cultivate as the creation mainly of German scholars. Looking back from the vantage ground reached after seventy-five years of history, it seems fair to say that in this respect the "Address" put forth by our founders was true to the facts.

For the historians of statistics are now well agreed that the study we cultivate sprang from two main roots, one in the German universities, the other in English studies of political arithmetic. The former developed, under the name of statistics, a descriptive political science almost devoid of figures but systematic and suitable for presentation in academic lectures or treatises. The latter developed, under the name of political arithmetic, a series of fragmentary and disconnected studies of available numerical data. Between 1730 and 1830 the English ideas slowly penetrated Germany, introducing numerical data and gaining especially from Süssmilch a

systematic, orderly presentation quite alien to their original form.

During the same period the German name *statistics* spread to England and this country. Probably the first writer to make it at home in English was Sir John Sinclair whose voluminous *Statistical Account of Scotland* exercised a traceable influence on both sides of the Atlantic. He wrote in 1798: "In the course of a very extensive tour through the northern parts of Europe which I happened to take in 1786 I found that in Germany they were engaged in a species of political inquiry to which they had given the name of Statistics and . . . as I thought that a new word might attract more public attention I resolved on adopting it and I hope that it is now completely naturalized."* The earliest occurrence of *statistics* in English was in 1770 and thus more than fifteen years before Sinclair, when Dr. Hooker published a translation of Bielfeld's *Elements of Universal Erudition*. One of its chapters is entitled Statistics and contains a definition of the subject as "The science that teaches us what is the political arrangement of all the modern states of the known world."† With this German name came also some of the German fondness for system and for breadth of treatment, and all these factors contributed to the establishment of English and American statistical societies. The statistics which were thus to be studied came much nearer to the German prototype than to the English political arithmetic.

This sketch of the origin of English and American statistical societies suggests, though I would not claim that it establishes, certain conclusions which a more thorough study of their history would probably substantiate.

1. Local statistical societies have been more short-lived than national statistical societies. Of the numerous English local societies only that of Manchester survives. We may regard our society's ambitious name as having been favorable to its permanence. Had it called itself the Boston Statistical Society or the Massachusetts Statistical Society, its chance of survival would have been less.

*Sinclair, *Stat. Account of Scotland*, XX, xiii.

†Hooker's, Bielfeld, *Elements of Universal Erudition*, III, Chap. XIII, 269.

2. Statistical societies established at the capital of a country have had a better opportunity to grow than similar societies established elsewhere. The Paris Statistical Society has long since outstripped the older Grenoble Statistical Society and has become in fact, though not in name, the statistical society of France; the statistical society of London, in recognition of its actual status and its fifty years of work was privileged in 1887 to change its name to The Royal Statistical Society; the Frankfort Association for Geography and Statistics, though founded in 1836, is of secondary importance.

3. The modern tendency is to make statistical societies peripatetic. This is almost necessarily true of international organizations like the Congresses of Statistics, the Congresses of Hygiene and Demography, and the International Statistical Institute; it is true of all three German statistical associations, namely, the Association of Imperial and State Governmental Statisticians, the Union of German Municipal Statisticians, and the German Statistical Society; of recent years our own Association has amended its charter with this object in view.

4. It is often wise for a statistical society to affiliate temporarily or permanently with other scientific societies. But its best connections lie with societies devoted to economics, political science, and law rather than with the natural or physical sciences. The economic and statistical sections of the British Association for the Advancement of Science and of the American Association for the Advancement of Science have had a checkered career and have at times been viewed askance by the parent organizations. The contrast between the origin of the British Statistical Society in 1834 as an offshoot from the statistical section of the British Association and the origin of the German Statistical Society in 1910 as a section of the German Sociological Society illustrates the change in this particular in seventy-five years. Hence our tendency to hold our recent annual meetings in connection with those of the economic, sociological, and historical associations seems in accord with the general trend.

5. A local statistical society exerts a strong influence in creating or maintaining sound work in statistics. When one thinks of the pioneer work of Shattuck, Jarvis, Walker,

Wright, Abbott, and Dike, to mention only the dead, and of the long years during which the censuses and the registration reports of Massachusetts have trained men or furnished models for other states and the country, one cannot but feel that the American Statistical Association with its headquarters in this city has materially aided in giving Massachusetts its historic position of leadership in American statistics.

6. The main end of the earlier statistical societies was the cultivation of statistics in the sense of Quetelet's early definition, "The representation of a State at a given point of time,"* or, in other words, a description of a country or locality expressed so far as possible in numerical terms, and, in pursuit of that end, if the needed material did not exist, the statistical society sought to gather it by independent inquiry. Thus, the fourth Annual Report of the Council of the Statistical Society of London describes the work of the following committees: (1) A committee to inquire into the state of education in London; (2) A committee to gather statistics of strikes and combinations in the United Kingdom; (3) A committee to gather statistics regarding population, births, marriages, and deaths; (4) A committee to gather statistics regarding crime. The laborious character of such work and the tendency of the government to take it over were important influences tending to limit the activities and shorten the days of these societies.

7. The main end of statistical societies like ours is or should be to furnish a center around which official statisticians and private statisticians may meet and fraternize. There has long been some danger that these two groups might work at cross purposes, the producer of statistics resenting the criticism of private students who have sometimes been ignorant and content to remain ignorant of the real difficulties besetting the path of the official and whose criticisms in consequence have been unintelligent or unjust, the user of statistics condemning the output of an office because it does not meet his needs or satisfy his special requirements. Statistics, unlike economics or sociology, is an art, a profession, as well as a science and is often, perhaps usually, guided quite as much by

*Quoted by Rawson W. Rawson in Stat. Soc., *Journal*, Jubilee vol., p. 8.

administrative as by scientific aims. Not that the truth is wrested or concealed, but that the whole truth can never be ascertained and that part which is presented must be determined mainly by the needs of administration. To further this end the meetings of a statistical society are far more important than its publications.

This review of the past history and present condition of statistical societies naturally leads to the question of coöperation between academic and official statisticians. Most of the larger American institutions offering statistical courses lay stress upon laboratory practice. The real laboratory is an adjacent statistical office, just as the real laboratory for a medical school is a hospital, and university courses in statistics on the practical side are likely to be somewhat dilettante until both university course and statistical office are so modified that they can work together to mutual advantage. When a university offering a course in statistics is situated in or near a great city or a state capital, it should be or become possible for the teacher to present and interpret the statistics of that city or state. This could be done to greater advantage, if the teacher of statistics were officially connected with the public office or the government statistician were given a university appointment. Such relations have been common in continental countries. I need only mention Dieterici, Engel and Boeckh at Berlin, Hermann and von Mayr at Munich and Neumann-Spallart, Inama-Sternegg, von Juraschek and Mischler at Vienna. The importance of this suggestion leads me to quote a few sentences regarding the statistical seminars of Engel at Berlin and of Inama at Vienna. Of the seminar which Engel started at Berlin after he had been made Director of the Prussian Statistical Bureau Blenck wrote:

"In November, 1862, he opened a statistical seminar in which the theory and technique of statistics and the interrelations between statistics, administration and legislation were investigated and statistical theses written in connection with the current work of the Bureau. This seminar proved of great educational value to many young men who afterwards devoted themselves to administration or were appointed to chairs for political science and statistics in the German

universities. Among these were Meyer, Oncken, Schönberg, Knapp, Held, Brentano, Cohn and Elster. High officials, members of the legislature, or persons connected with foreign embassies in Berlin were among the regular attendants."*

At Vienna in the 70's there had been a seminar in connection with the Central Statistical Commission. Inama transferred it to the University. It rendered the double service of training university students in the science of statistics and utilizing statistics as a method of gaining scientific knowledge. Under Inama's leadership from 1882 to 1905 it gained an international reputation and trained a great number of distinguished statisticians. Almost all the professorships of statistics in Austrian universities are held by men trained in it and many important works have originated there. In this way a statistical school has grown up, extending and continuing the ideas of the head.†

As evidence that such work is needed I may also quote a resolution adopted at the ninth and last International Statistical Congress: "The Congress believes that the teaching of theoretical statistics at the universities should be supported by practical conferences and that to secure this result statistical libraries should be formed in connection with departments of statistics and statistical bureaus should, if possible, establish connections with teachers of statistics, although entire independence should be assured to each side."‡

Work of this sort, I believe, is more needed in the United States today than any other line of statistical development. Perhaps the nearest approach to it that we have ever had was the group of young men who gathered around Carroll D. Wright during the twenty years when he was at the head of the Federal Bureau or Department of Labor. Since the retirement of Mr. Wright, no one in Washington has done work of this description. Neither in the Census Bureau nor in any of the smaller statistical offices is there an opportunity to get a training in statistics which would qualify one to rise to the most important statistical positions there or elsewhere.

*Free and abridged translation from Intern. Stat. Inst., *Bulletin*, X, pt. ii (1897), 141.

†Free and abridged translation from von Juraschek in *Stat. Monatschrift*, XXXII (1906), 12.

‡Inama-Sternegg in *All. Stat. Archiv*, I (1890-91), 16, footnote.

This is the more important because the rapid development of public health work and of vital statistics as tributary to it is creating a demand for men trained in demography, which neither our bureaus nor our universities are doing much to fill. It might be said in reply that even the highest positions are not yet thought to demand professional training or held on a secure and permanent tenure. But the objection is not unanswerable. Is not the true relation one of interdependence? Is not the lack of a public demand for professional standards among official statisticians due in the main to public ignorance of the added significance and value a well trained man can give to statistical inquiries and their results? If so, are not the men best able to create this demand the private scholars and teachers of statistics? Is not the best method for them to follow that of constructive criticism of current statistical inquiries and interpretation of their results beyond the point at which they are left by the office which issues them?

In many university courses in statistics, laboratory exercises are included, but there is apparently no agreement regarding the scope and character of these exercises. In my opinion they should, if possible, be given definiteness and practical significance by being used to criticise or interpret the statistical results obtained in communities in which the class is interested. This might be the university community, the town or city in which the university is located or the student lives, or even the state as a whole. I cannot but feel that there may be some danger of turning the attention of the class too exclusively either to graphic methods of representing results or to mathematical methods of determining the exact degree of correlation. Doubtless each of these has a place and an important place in a course of statistics, but neither strikes at the spot in which most errors are found, namely, the original returns. In studying tuberculosis, for example, to make elaborate corrections for differences in the age and sex distribution of the population and of decedents in successive periods and to pass in silence the question of the comparative accuracy of diagnosis at the different dates is to strain at a gnat and then swallow a camel. For a large major-

ity of statistical errors are those which creep into the raw material and cannot be eliminated by any refinements of mathematical analysis or any skill in graphic representation. To center attention on these field errors has the incidental advantage of bringing home to the student as nothing else can the real difficulties before the official statistician and of fostering that mutual understanding and sympathy between teachers and officials so necessary for hearty, continuous coöperation.

If I am right in my opinion that the best service the American Statistical Association can render to the progress of statistics is by bringing together for purposes of friendly discussion and coöperation the producers and consumers of statistics, then perhaps the future policy of the Association might be modified in order better to secure that end. Would it be well for us to try the experiment of establishing standing committees like those which did good work in the early years of the London Statistical Society? Perhaps committees on Federal work, on state work and on municipal work might be helpful. Perhaps a committee on the teaching of statistics might be organized, or a committee on infant mortality. Certainly our society should not follow the position of the economic or sociological societies and confine its work in the main to papers and discussions not ripening into recommendations. Our main duty is to improve Federal, state, and municipal statistics in the United States, and this we should hope to do not only by the example of our members but also by the precept of formal recommendations.

THE ECONOMIC PROGRESS OF THE UNITED STATES DURING THE LAST SEVENTY-FIVE YEARS.*

By Frederick L. Hoffman, LL.D.

The present discussion is limited to verifiable evidences of our national progress since 1840. The period of time considered does not always constitute an exact three quarters of a century. For many factors of our national progress the statistical data are not available for so long a period of years. For the principal elements the rate of progress has been determined for the seventy years commencing with 1840, or the year following the establishment of the American Statistical Association, and ending with the year 1910, or the date of the last federal census. Preliminary to the taking of the census of 1840, a most interesting volume on "The Principles of Statistical Inquiry as Illustrated in Proposals for Uniting an Examination into the Resources of the United States with the Census to be Taken in 1840" was published in 1839. The author of this work was Archibald Russell, of whom little is known at the present time, but who rendered a distinct service to the nation, for, as said by Carroll D. Wright in his History of the United States Census, "The census of 1840 may be said to mark the beginning of the concerted effort to make the decennial enumeration the instrument for ascertaining something beyond the mere number of persons of each sex and of various ages, constituting each of the three great divisions of the population. (That is, white persons and colored persons, whether slaves or freedmen.)" President Van Buren in his second annual message, dated December 8, 1838, had made the suggestion as to "whether the scope of the measure might not be usefully extended by causing it to embrace authentic statistical returns of the great interests especially entrusted to or necessarily affected by the legislation of Congress." A memorial was presented by the American Statistical Association to Congress in 1843, in which it was set forth that

* Address at the Seventy-fifth Anniversary Meeting of the American Statistical Association, Boston, Mass., February 14, 1914.

various and gross errors had been discovered in the printed edition of the Sixth Census, but that the committee of the association appointed to investigate the matter and report thereon to Congress, not having reliable data with which to compare all the details of the census, confined their investigations to the reports respecting education, nosology, and employments. The memorial of the association is given in full in House Reports, 28th Congress, First Session, Vol. III, No. 580. The treatise by Russell, no doubt, had much to do with the enlarged plan and scope of the census of 1840, including, aside from a discussion of the general principles of statistical inquiry, a consideration in detail of the statistics of arts and manufactures, agriculture, occupations, place of nativity, vital statistics, crime, pauperism, education, the clergy, taxation, as well as observations on the agents to be employed in procuring accurate statistical information. Mr. Russell's connection with the census of 1840 is not made clear, for the only name mentioned in Wright's History of the Census is that of William A. Weaver, of Virginia, who served as superintending clerk in the Department of State until March 18, 1842.

During the intervening seventy years the United States census has become a truly colossal institution. Additional thereto an equally enormous amount of statistical knowledge regarding the social and economic condition of the people is made available through the statistical offices of the several states and municipalities and private institutions and corporations. It would be utterly impossible, within the limitations of this address, to even briefly discuss all of the essential factors which have conditioned the moral, physical, and material advance of the American people since the establishment of the American Statistical Association in 1839. For the present purpose, therefore, the discussion will be limited to about the same plan and scope as the treatise by Russell in 1839, but amplified, as far as necessary, to present a comparative outline of the salient facts of practical value at the present time.

Before I take up the statistical facts of the discussion, it may not be out of place to refer very briefly to some of the earlier investigations made to ascertain and disclose the prog-

ress of the United States. The term "progress" is used in the generally accepted sense of the word. "Progress," said Arnold Toynbee, "comes chiefly from without; it is external pressure which forces men to exert themselves, but," as he observes subsequently, "competition may produce wealth without producing well-being," and it is, therefore, necessary to keep at all times in mind the possibility of erroneous interpretation of the mere facts which emphasize our numerical or material advance. At the same time, for practical purposes there is no other convenient measure of our human evolution from a primitive condition of society to civilization. Tench Coxe, as early as 1794, published his "View of the United States of America," illustrating by reference to authentic documents "the progress and present state of civil and religious liberty, population, agriculture, exports and imports, fisheries, navigation, ship-building, manufactures, and general improvement." The term "progress," as used in this treatise, implies primarily the material progress of the nation as the prerequisite for its social, intellectual, and spiritual advance. An interesting statistical manual entitled "Economica," by Samuel Blodget, was published in 1810. This also is practically a treatise on the material growth of the nation in all the essentials which constitute the evidences of a country in process of development from the crude conditions of original settlement to that of civilized well-being. This work is of special value as illustrating some of the earliest references to Franklin's speculations on population, the utility of statistics of births and deaths, and, finally, the number of insurance companies, the amount of their capital, the variation of money as expressed in wages, and the price of wheat, and, finally, the number of stockholders of banks, insurance companies, turnpikes, etc.

The next treatise on the progress of the country was published in 1817 by Timothy Pitkin, entitled "A Statistical Review of the Commerce of the United States of America in connection with Agriculture and Manufactures and an Account of the Public Debt, Revenue, and Expenditures." Following this work there was published the elaborate Statistical Annals, embracing views of the population, commerce, navigation,

fisheries, public lands, post-office establishments, revenues, mints, etc., of the United States of America, by Adam Seybert, in 1818. This work contains some very interesting observations concerning population, the growth of commerce, the development of the military establishments, list of pensioners in the army and navy, remarks on the mortality of the United States, the death rate of cities, comparative statistics for Europe, and, finally, a table exhibiting the expectation of life in the city of Philadelphia, etc.

Following these, I can only mention Bristed's treatise on "The Resources of the United States," published in 1818; Darby's "View of the United States," published in 1828; Tucker's "Progress of the United States in Population, Wealth, etc., in Fifty Years," published in 1843; MacGregor's great work on "The Progress of America," published, in two volumes, in 1847; Seaman's essay on "The Progress of Nations in Civilization, Productive Industry, Wealth and Population," published in 1863; Lossing's memorial volume on "The American Centenary; or a History of the Progress of the Republic of the United States during the First One Hundred Years of its Existence"; and, finally, Gannett's work on "The Building of a Nation, its Growth, Present Condition and Resources," with a forecast of the future, published in 1894.

All of these authorities construe the progress of the nation to be the equivalent of its measurable advance by means of statistics in the direction of an increase in numbers, commerce, wealth, etc., and last, not least, longevity. The term "progress," as used by these writers of the highest authority, emphasizes a constant upward tendency towards the ideal of an ever larger share of individual material prosperity as the equivalent of the largest attainable degree of human happiness. Higher wages, shorter hours of labor, a lessened cost of production, increased opportunities for travel and recreation, universal suffrage—all are measurable by statistics, and accurately and conclusively by statistics alone. Progress in this sense always means social *improvement*, though obviously the vast number of conditions which affect human well-being and human happiness are at all times subject to a variable degree of change. Reviewing the world's progress from this

point of view, as measured by statistical evidence for the last seventy-five years, there can be no question of doubt but that, broadly considered, the world at large and in all its parts has enormously advanced, but nowhere has the rate of growth in all the essentials which constitute the material well-being of the people been greater than in the United States of America.

In the sense of these definitions and observations it would seem, also, Prof. W. J. Ashley, Dean of the Faculty of Commerce and Chairman of the Social Study Committee of the University of Birmingham, and one whose authority no one will question, construes the term "Progress" in the Year Book of Social Progress for 1913–14. He observes that "It is an unmistakable trait of our period that there is practically no difference of opinion as to what constitutes progress. *Improvement in the economic condition of the body of the people* is in the forefront of our attention: the touchstone we unconsciously apply to every social effort and proposal—rightly or wrongly, the typical men and women of today, who are alert and public-spirited, have before their mind's eye, as an obvious goal of endeavor, the vision of the whole people fed and housed sufficiently well to enable them, if they choose, to lead healthy and pleasant lives, freed from demoralizing irregularities of employment; with sufficient leisure for family affection and sufficient education for civic duties." This comprehensive and readily intelligible definition of progress underlies and limits the present discussion, which is concerned almost exclusively with what Walter Bagehot has properly called "verifiable progress," in the true and incontrovertible, common, every-day acceptance of the term.

The gross area of the continental United States increased from 1,792,000 square miles in 1840, by acquisition, concession, or purchase, to 3,027,000 square miles in 1914, and, including Alaska and insular possessions, to 3,743,000 square miles. The gross area of the continental United States now exceeds the combined area of the United Kingdom, Germany, Austria-Hungary, France, Spain, Italy, Scandinavia, Greece, the Balkan States, Egypt, Japan, and Mexico.

The total population in 1840 was 17,069,000. For 1914, our continental population is conservatively estimated at

98,648,000. The rate of increase during the intervening seventy-four years has been 478 per cent. The present population exceeds the combined populations of the United Kingdom and the empire of Austria-Hungary.

Our white population has increased from 14,196,000 in 1840 to 87,701,000 (estimated) for 1914. There has, therefore, been an actual increase during the intervening seventy-four years of 73,505,000, equivalent to a rate of growth of 6.95 per cent. per annum. The estimated corresponding growth of continental Europe during the same period of time was only 1.2 per cent. per annum.

The negro population of the United States increased from 2,873,000 in 1840 to 10,225,000 (estimated) for 1914. The rate of growth was, therefore, 255.9 per cent. for the intervening period, in contrast to a growth of 514.3 per cent. for the white population, which, of course, includes a substantial increase by immigration.

The number of Indians in 1840 is partly a matter of conjecture. It is doubtful whether the number exceeded 300,000. In 1865 a conservative estimate placed the number at 278,000, and for 1890 at 248,000. For 1914, largely on the basis of census enumerations, the number of Indians is conservatively estimated at 277,000. A large number of persons of Indian intermixture are considered white, and as such enumerated by the census. In contrast, even the slightest degree of known negro intermixture warrants, by present usage, the inclusion of such among the negroes.

The number of Chinese in 1840 was very small. By 1865 the number was 49,000, which by 1890 had increased to 107,000. In consequence of Chinese exclusion laws, the number has gradually diminished, being estimated for 1914 at 64,000.

In contrast, there has been a rapid increase in the Japanese population. In 1890 the Japanese numbered only 2,039, against an estimated Japanese population of 91,289 for 1914.

The foreign-born white population was not ascertained previous to 1850. In that year the census returned 2,240,000, which by 1910 had increased to 13,345,000, or 495.8 per cent.

The corresponding increase in the native white population was from 17,312,000 in 1850 to 68,386,000 in 1910, or 295

per cent. The native white population, however, includes a considerable number of native-born of foreign or mixed parentage. The number of such persons was not enumerated previous to 1870. In 1910 the number of persons of native parentage was 49,488,000; the native-born of foreign parentage was 12,916,000; and the number of native-born of mixed parentage, 5,981,000. The tendency of the population is towards a more varied composition, largely because of the enormous foreign immigration during the last forty years. No thorough analysis of the population problem has been made and it is therefore impossible to say with absolute accuracy whether there is a pronounced tendency towards gradual and complete assimilation of the foreign-born with the native-born of native parents. The indications are that this is not the case.*

During the twenty-five years ending with 1864, the number of immigrants arriving in the United States was 4,949,000. During the twenty-five years ending with 1889 the number arriving was 9,365,000. During the twenty-one years ending with 1912 the number arriving was 14,655,000. The component parts of the immigration during the last quarter of a century differ fundamentally from those of the influx previous to 1890. Of the total foreign-born population of the United States in 1900, 17.7 per cent. had its origin in southern and eastern Europe. In 1910 the corresponding percentage of this population was 37.4. Earlier returns would exhibit an even more striking contrast.

In 1840 the density of population per square mile was 9.7, which by 1865 had increased to 11.8, and by 1914 to 33.2. The corresponding present density of the German Empire is 310; of France, 191; of Austria-Hungary, 196; of the United Kingdom, 374; and of Belgium, 659. Even if the present growth of the American population continues during the next fifty years as it has in the recent past, the then attained density will be only one fifth of the present density of the German Empire.

*An immense amount of information on the subject of immigration and its social and economic aspects has been published in the forty-two volumes of the report of the United States Immigration Commission, Washington, D. C., 1911.

In 1840 about 8.5 per cent. of the population lived in cities of 8,000 population or over. By 1870 the proportion of urban population had increased to 20.9 per cent., and by 1910 to 38.9 per cent. The tendency of the country is, therefore, distinctly towards increased urbanization. Including localities having from twenty-five hundred to eight thousand population, the total urban population of the United States in 1910 was 42,623,000, or 46.3 per cent. of the aggregate, against 29.5 per cent. in 1880. During the last decade the population of urban territory increased 34.8 per cent., against an increase of only 11.2 per cent. in the rural territory. During the last ten years the rural population actually diminished in New Hampshire, Vermont, Ohio, Indiana, Iowa, and Missouri. In all of these states the urban population increased considerably. The total number of cities in the United States in 1910 with eight thousand inhabitants and over was 786, against only 44 in 1840.

The number of farms in 1850 (there being no earlier returns) was 1,449,073. By 1910 the number had increased to 6,361,502. The amount of acreage in improved farm lands increased from 113,032,000 in 1850 to 478,452,000 in 1910. During the same period of sixty years, the average acreage per farm diminished from 202 to 138 acres, but the percentage of total land area in farms increased from 15.6 in 1850 to 46.2 in 1910. The value of farm property increased from $3,967,000,000 in 1850 to $40,991,000,000 in 1910. The average value of all property per farm, which in 1850 was only $2,738, increased by 1910 to $6,444, and the average value of all property per acre of land in farms increased from $13.51 to $46.64. Considered from another point of view, it may be said that against an increase in population during the last sixty years of 297 per cent., the number of farms has increased 339 per cent.; the amount of improved land in farms, 323 per cent.; and the value of farm property, 933 per cent.

During the last twenty years (there being no earlier data) the proportion of farms free from mortgage decreased from 71.8 per cent. in 1890 to 66.4 per cent. in 1910; and the ratio of debt to farm value decreased from 35.5 per cent. to 27.3

per cent. There was a corresponding increase in the average equity per farm, from $2,220 in 1890 to $4,574 in 1910.

The amount of irrigated farm acreage increased from 3,631,000 acres in 1889 to 13,738,000 in 1909.

The corn crop of the United States increased from 377,000,000 bushels in 1840 to 3,124,000,000 in 1912, or 729 per cent.; the wheat crop increased during the same period from 84,000,000 bushels in 1840 to 730,000,000 in 1912, or 793 per cent.; and the wool-clip increased from 35,000,000 pounds in 1840 to 304,000,000 in 1912, or 769 per cent. The corresponding increase in the sugar crop was from 120,000,000 pounds in 1840 to 1,922,000,000 pounds in 1912, or 1502 per cent. and the cotton crop increased from 1,347,000 bales in 1840 to 14,295,000 bales in 1912, or 961 per cent.

The production of gold in 1840 was estimated at $11,000,000. By 1880 this had increased to $36,000,000, and by 1912 to $91,000,000. The production of coal in 1840 was only 1,848,000 tons; by 1880 the production had increased to 63,000,000 tons; and by 1912 to 477,000,000 tons. The corresponding increase in the production of copper was from 100 tons in 1840 to 27,000 tons in 1880, and 557,000 tons in 1912. There was no recorded cement production in 1840, and by 1880 the amount had reached only 2,000,000 barrels, which by 1912 had increased to 83,000,000 barrels. There was also no recorded petroleum production in 1840, the earliest returns being for the year 1859. By 1880 the production had reached 1,000,000,000 gallons; and by 1912, 9,328,000,000 gallons. The pig iron production amounted to only 286,000 tons in 1840, and 3,335,000 tons in 1880, but by 1912 the production had reached nearly 30,000,000 tons. Corresponding gains were made in the production of practically all the other important mineral resources.

The census of 1850 was the first to present approximately complete statistical data regarding the manufacturing industries of the country. The information collected was for the year 1849, and subsequently thereto corresponding information has been secured by census enumerations. The number of manufacturing establishments, according to the census of 1850, was 123,025, and according to the census of 1910, 268,491.

The census definition of a factory, however, was changed in 1899, so that an exact comparison is not possible. The number of wage-earners employed in manufacturing industries in 1849 was 957,000, which by 1909 had increased to 6,615,000, or 591.2 per cent. The amount of wages paid increased during the same period of time from $236,000,000 to $3,427,000,000, or 1352.1 per cent.; and the value of the product increased from $1,019,000,000 in 1849 to $20,672,000,000 in 1909, or 1928.7 per cent. It is regrettable that the statistical data should not be strictly comparable, but the foregoing comparison approximately measures the remarkable progress of the manufacturing industries during the last sixty years.

The statistics of occupations by age and sex are not yet available for the census of 1910. It is possible, however, to give some statistics for manufacturing industries which indicate a progressive decline in the proportion of child-labor, or persons under sixteen years of age. In 1899 the proportion thus employed was 3.4 per cent.; in 1904, 2.9 per cent.; and in 1909, 2.4 per cent. These statistics are incontrovertible evidence that, regardless of a rapidly expanding interest in manufactures, the relative number of young persons employed therein has declined, for during the same period of time the number of male wage-earners increased from 3,632,000 in 1899 to 5,163,000 in 1909, or 42.2 per cent.; and the number of female wage-earners increased from 918,000 in 1899 to 1,290,000 in 1909, or 40.5 per cent. The number of persons under sixteen years of age employed in manufacturing industries remained almost the same, or 161,276 in 1899, against 161,493 in 1909. There can be no question of doubt that if it were possible to carry these statistics further back, to the earliest census periods, an even more gratifying reduction in the proportion of child-labor in manufacturing industries would be shown. These conclusions, of course, do not apply to the child-labor problem at large, but only to child-labor in manufacturing industries.

Wages and hours of labor can only be very briefly discussed, partly on account of the paucity of data and partly because of the technical difficulties of the subject. Data presented in the report of the Senate Finance Committee, published in

1893, on wholesale prices and wages indicate that the relative wages in gold, in all occupations considered, changed from a rated average, according to importance, of 82.5 in 1840 to 100 in 1860, and 168.6 in 1891. As observed by the Committee, "From a consideration of the foregoing data, it becomes evident that there was a gradual advance in wages from 1840 to 1860, and since that date the advance has been less regular but more rapid. The period from 1875 to 1880 was marked by a standstill, but since then the advance has been continuous." Since 1890 a number of investigations have been made by the Bureau of Labor Statistics, all of which conclusively show that there has been a further and substantial advance in the rate of wages paid in the principal industries. For illustration, in the boot and shoe industries, relatively, wages increased from 98.5 in 1890 to 132.8 in 1912, the period 1890–99 being taken as one hundred. During the same period relatively nominal full-time hours per week diminished from 100.3 in 1890 to 93.9 in 1912. In other words, the relative wages were highest and the relative hours of labor were lowest during the last year for which the data are available. In the hosiery and knit-goods industries, the relative rate of wages advanced from 105.6 in 1890 to 143.7 in 1912. The relatively nominal full-time hours per week diminished during the same period from 101.1 in 1890 to 93.1 in 1912. In other words, in this industry, also, the relative rate of wages was the highest, and the relative hours of labor the lowest, in 1912, for any year since 1890. These two industries may be considered fairly typical and conclusive evidence that the two most concise illustrations of labor progress indicate a measurable advance in this direction of social welfare since 1840, an advance, in fact, so considerable that the present social condition of labor may properly be referred to as being in marked contrast for the better with the prevailing conditions of seventy-five years ago.

The corresponding progress made in other directions of labor conditions can not be so concisely stated in statistical terms. This observation applies particularly to the prohibition of night-work for women and young persons, the gradual attainment of a ten-hour maximum working-day for women

and children, the improvements in health conditions in industry, the diminution in the rate of frequency of occupational diseases, and the reduction in the rate of industrial accidents, both fatal and serious. There are reasons for believing that the rate of unemployment in the principal industries is decidedly less at the present time than in former years, and that otherwise the economic condition of labor has distinctly improved, largely because of the more effective organization of industry, insuring a much larger amount of continuous employment than under the earlier conditions of excessive competition and disorganized business methods.

There are no complete statistics of American business as chiefly represented by wholesale and retail mercantile establishments. Perhaps the most trustworthy index of business prosperity is the annual record of commercial failures, which dates from the year 1857, made memorable by a disastrous financial panic. In that year the number of failures was 4,932, and the amount of liabilities $291,000,000. No such amount of liabilities became involved again until 1893, when there were 15,242 failures, with $347,000,000 of liabilities. This was the maximum figure reached in American commercial history, the number of failures during 1913 numbering 15,452, the amount of liabilities being $203,000,000. In proportion to the total number of business concerns, the highest proportionate rate of failures since 1885 occurred in 1896, or 1.31 per cent. The corresponding figure for 1913 was 0.98 per cent. Considering the enormous increase in the nation's business, it is safe to assume that there has been a decided improvement in business stability throughout the country, at least during the last twenty years.

The amount of government revenue per capita has increased from $1.14 in 1840 to $7.46 in 1913. During the last year of the Civil War the per capita amount of government revenue reached $9.26.

The total ordinary disbursements of the government have increased from $24,000,000 in 1840 to $683,000,000 in 1913. Disbursements on account of the Army increased from $7,000,000 in 1840 to $1,030,000,000 in 1865, diminishing to $44,000,000 by 1890, but increasing to $161,000,000 by 1913. The

expenditures on account of the Navy increased from $6,000,000 in 1840 to $122,000,000 in 1865, diminishing to $22,000,000 by 1890, but increasing to $133,000,000 by 1913. Disbursements on account of pensions increased from $2,600,000 in 1840 to $16,347,000 in 1865, and $175,000,000 in 1913.

The public debt, less cash in the treasury, increased from a per capita of $0.21 in 1840 to $76.98 in 1865, when the aggregate debt was $2,674,816,000. The per capita diminished to $14.15 by 1890, and to $10.83 in 1913. The aggregate amount of the debt in the latter year was $1,050,000,000.

The total imports of merchandise in the United States increased from $98,000,000 in 1840 to $1,813,000,000 in 1913, or 1750 per cent.

The exports during the same period increased from $111,000,000 in 1840 to $2,170,000,000 in 1912, or 1864 per cent.

The amount of foreign trade carried in American vessels has diminished rapidly between 1840 and 1912. The amount of imports carried in American vessels in 1840 was 86.6 per cent. of the total, against only 11.0 per cent. in 1912. The amount of exports in American vessels during the same period decreased from 80.0 per cent. to 8.1 per cent.

The amount of tonnage engaged in coastwise trade increased from 1,226,000 tons in 1840 to 3,832,000 in 1912, or 212.5 per cent. The tonnage on the Great Lakes increased during the same period from 54,000 to 2,950,000 tons. The traffic through the Soo Canal increased from 106,000 tons in 1855 to 8,454,000 tons in 1890, and 56,737,000 tons in 1912.

The railway mileage of the country in 1840 was only 2,818. By 1865 the mileage had increased to 35,085, and by 1890 to 208,612. For the year 1912 the reported mileage was 356,372. Our aggregate railway mileage exceeds the combined railway systems of Austria-Hungary, Canada, France, the German Empire, Italy, Russia, the United Kingdom, Brazil, and all Australia.

There were neither telegraphs nor telephones* in operation in 1840. By 1867 the number of telegrams sent was only 5,879,000; by 1912 this had increased to 109,378,000.

*See Bulletin No. 123 entitled "Telephones and Telegraphs, 1912," issued by the United States Bureau of the Census, Washington, 1914; also the "Annual Report of the Directors of American Telephone and Telegraph Company" for the year ending December 31, 1913, New York, 1914.

The telephone mileage in 1880 was 34,000, this by 1912 had increased to nearly 20,250,000. The number of persons employed in the telephone industry increased from 3,338 in 1880 to 183,000 in 1912.

The postal revenue of the United States increased from $4,543,000 in 1840 to $246,744,000 in 1912, or 533.1 per cent.

The number of patents issued during the quarter-century ending with 1864 was 49,071; during the quarter-century ending with 1889, 399,724; and during the period 1890–1912, 656,862.

The banking business of the nation has enormously developed, largely, no doubt, in consequence of the passage of the National Banking Act in 1863. The number of national banks increased from sixty-six in 1863 to 7,473 in 1913; and the amount of loans and discounts of national banks increased during the same period from $5,466,000 to $6,143,000,000. The amount of capital paid in was $1,056,000,000 in 1913. The amount on deposit in national banks increased from $119,000,000 in 1864 to $5,963,000,000 in 1913. Statistics of state banks are available for 1840, when the amount on deposit was $75,696,000. Subsequent to the National Banking Act the amounts declined, but a persistent growth has taken place since 1878, when the amount on deposit was $142,000,000, increasing to $553,000,000 by 1890, and to $2,920,000,000 in 1912. Statistics of loan and trust companies are not available previous to 1875, when the amount on deposit was $85,000,000, which by 1912 had increased to $3,674,000,000. The amount on deposit in private banks declined from $321,000,000 in 1875 to $152,000,000 in 1912; but during recent years this form of banking has also shown indications of substantial growth.

The number of savings bank depositors in 1840 was 78,701, which by 1912 had increased to 10,010,304. The amount on deposit in savings banks during the same period of time increased from $14,000,000 to $4,451,000,000, or 317 per cent. The average amount on deposit in savings banks increased from $178.54 in 1840 to $444.70 in 1912.

The total amount on deposit with all banks* increased from

*National, state, and savings banks and trust companies.

$2,182,000,000 in 1875, or $49.64 per capita, to $17,024,000,000 in 1912, or $178.43 per capita.

The amount of money in circulation increased from $10.91 per capita in 1840 to $20.58 in 1865, and $34.64 in 1913.

There are no statistics of local building and loan associations for the nation as a whole previous to 1892. In that year the number of shareholders was 1,359,000, which by 1913 had increased to 2,517,000 or 85.2 per cent. The corresponding growth in population during the same period of time was 49.0 per cent. The amount of assets increased from $473,000,000 in 1892 to $1,137,000,000 in 1913.

There are no trustworthy statistics of legal-reserve life insurance previous to 1860. In 1865 the number of policies in force was 209,392, which by 1890 had increased to 5,202,000, and by 1912 to 34,855,000, including the industrial business, which dates from 1875. The amount of legal-reserve life insurance in force increased from $580,000,000 in 1865 to $19,264,000,000 in 1912. During the same period of time the accumulated assets increased from $64,000,000 to $4,409,000,000. The amount of legal-reserve life insurance per capita was $16.70 in 1865, and $201.90 in 1912.

For the United States as a whole there are no trustworthy statistics of fraternal and assessment insurance previous to 1885. In that year, according to the best obtainable returns, there were 714,356 certificates in force, insuring $1,484,000,000, which by 1912 had been increased to 10,477,618 certificates and $9,924,000,000 of insurance in force.

Nor are there any trustworthy statistics of fire and marine insurance previous to 1890. In that year, according to *The Spectator*, a New York insurance journal, there were 580 companies operating in the United States, with a total income of $157,000,000, which by 1911 had increased to 621 companies, with an aggregate income of $410,760,000. The payments to policyholders, including the business of Lloyd's and inter-insurance associations, increased from $80,000,000 in 1890 to $203,000,000 in 1912.*

* According to *The Spectator*, the amount of marine and inland insurance in force in the United States has increased during the last ten years from $388,730,000 in 1903 to $1,160,896,000 in 1912. During the same period the losses incurred by the marine and inland insurance companies increased from $10,300,000 in 1903 to $16,622,000 in 1912.

In 1890 there were thirty-four companies transacting casualty and miscellaneous insurance, with a total income of only $9,758,000, which by 1912 had increased to 189 companies, with an income of $137,700,000. The annual payments to policyholders during the corresponding period of time, increased from $2,933,000 to $55,957,000.

Statistics of fire losses date back to 1875, when the reported loss to the National Board of Fire Underwriters was estimated at $78,000,000. For the year 1890 the estimated loss was $108,000,000, and for the year 1911, $217,000,000. There are no available statistics of maritime losses for a corresponding period of time. The evidence, however, is quite conclusive that all forms of insurance have made rapid progress during the last thirty years, and largely out of proportion to the corresponding growth in population, but in conformity to the vast expansion in commerce, of which insurance, in all its branches, is an essential element and necessary instrumentality. .

Estimates of the wealth of the United States are largely a matter of conjecture. For the present purpose the data published in the Statistical Abstract are accepted as approximately trustworthy, but there are reasons for believing that the amount of actual wealth is in excess of the estimate, which is exclusive of many sources more or less intangible, but none the less important. There are no estimates previous to 1850, when the total amount was placed at $7,135,000,000, or $307.69 per capita. By 1865, regardless of a vast amount of wealth destruction in the form of material property and slaves, the figure was placed at $23,114,000,000, or $646.86 per capita, which by 1890 had increased to $65,037,000,000, or $1,035.57 per capita. For the year 1914 the national wealth is conservatively estimated $140,560,000,000, or $1,424.86 per capita.

The educational progress of the nation is measured by the proportion of illiterates, ages ten and over, in the total population, ages ten and over. There are no data previous to 1880. In that year the illiterate population was 6,240,000, or 17.0 per cent. of the total. By 1900 the actual number of illiterates had diminished to 6,180,000, or 10.7 per cent. of the

total, and by 1910 to 5,516,000, or 7.7 per cent. Of the illiterates in 1910, 40.4 per cent. were negroes, and 25.0 per cent. native whites of native parentage.

The total school enrolment has increased from 7,743,000 in 1872, or 19.0 per cent. of the total population, to 20,879,000 in 1911, or 22.3 per cent. There can be no question but that the nation has made real educational progress, not only as measured by the rather crude educational statistics, but much more so by the larger proportion of population of school age in the higher institutions of learning.

There are no recent statistics of marriages for the nation as a whole, but the returns for Massachusetts may possibly indicate present-day tendencies in the more densely populated section of the country with approximate accuracy. During the period 1850-54 the marriage rate of Massachusetts was 16.8 per one thousand of population, ages fifteen and over, decreasing to 13.6 during the five years ending with 1864, to 12.7 during the five years ending with 1890, and to 12.5 during the five years ending with 1911.

In this connection, a brief reference may be made to the statistics of divorce, as having an important bearing upon our moral progress, but no data are available previous to 1867. It is a statistical fallacy to determine the ratio of divorces to the marriages contracted during the current year in which the divorces were granted. The statement frequently made that in this country 1 marriage in every 12 terminates in a divorce is a serious and inexcusable statistical error. In 1910, for illustration, there were 18,098,000 married males in the United States and only 156,000 divorced males. The ratio of divorced men to married men was, therefore, 1 to 116. The number of married women was 17,688,000, and the number of divorced women 185,000. The ratio of divorced women to the married was, therefore, 1 to 96. The annual divorce rate per one hundred thousand married population has increased, however, from 81 in 1870 to 107 in 1880, 148 in 1890, and 200 in 1900. The condition is alarming, but not as serious as frequently assumed. Divorces attract vastly more attention than marriages, and they are naturally drawn from the existing body of the married and not by any means exclusively from the

marriages contracted during the year in which the divorces were granted. Of the total married, widowed, or divorced male population in 1910 only 0.79 per cent. were divorced. For the female population the corresponding figure was 0.88 per cent.

There are also no trustworthy statistics of births for the nation as a whole, but using again the statistics of Massachusetts, it appears that the birth rate has declined from 100.4 per one thousand of females, ages fifteen to forty-nine, during the five years ending with 1854 to 90.8 during the five years ending with 1911. It may be questioned, however, whether the actual decline in the birth rate has not been more pronounced than is indicated by the foregoing rates of a state in which the conditions have been seriously disturbed by a large influx of distinctly fertile races, such as French Canadians, Italians, and Portuguese. Without enlarging upon the statistical aspects of the problem, it may be safely assumed, on the basis of reasonably trustworthy data, that there has unquestionably been a material decline in American fecundity and the size of the family and a corresponding increase in the proportion of native married women without children. This view is sustained by the maternity statistics of Rhode Island and by the special analysis of the United States census of 1900 for selected localities.*

The health progress of the nation since 1840 is concisely shown by the vital statistics of our large cities. Combining the available data for the seven cities of New York, Philadelphia, Chicago, Boston, Lowell, Baltimore, Charleston, and New Orleans, it appears that the death rate for the five-year period ending with 1844 was 24.2 per one thousand, against 27.6 for the five years ending with 1864, 23.2 for the five years ending with 1894, and 16.4 for the five years ending with 1912. The most notable documents on the health history of the nation at early periods are the first report of the Committe on Public Hygiene of the American Medical Association, published in 1849; the Report of a General Plan for the Promo-

* See "Maternity Statistics of the State of Rhode Island," by the present author, Proceedings First International Congress of Eugenics, London, England, also "The Comparative Fecundity of Women of Native and Foreign Parentage in the United States," by Joseph A. Hill, Quarterly Publications of the American Statistical Association, No. 104, December, 1913, Boston, Mass.

tion of Public and Personal Health, made by the Sanitary Commissioners appointed by the Massachusetts Legislature and published in 1850; and the report of the Executive Committee to the Council on Hygiene upon the Progress and Present Condition of Sanitary Inquiry, published by the Citizens' Association of New York in 1865. Mention may also be made of the report on the Causes and Prevention of Yellow Fever at New Orleans and other cities in America, published in 1857, and the report of the United States Government on the Cholera Epidemic of 1873. The first state to inaugurate the registration of vital statistics was Massachusetts, commencing in 1857.

The most notable decline in American mortality has been in the death rate from tuberculosis. A material reduction, however, also has taken place in the mortality of infants, and in the mortality from all of the acute infectious diseases, including smallpox which as a cause of death has practically been eliminated. There has been no cholera epidemic since 1879, and practically no yellow fever since 1905. The fall in the death rate, however, has chiefly affected ages under forty, and some of the degenerative diseases of adult life, including cancer, have increased.

Statistics of inmates of institutions are available only with approximate accuracy since 1890. At the time of the Eleventh Census the rate of inmates of all institutions for the defective and dependent classes was 590 per one hundred thousand of population, against 808 in 1900, and 915 in 1910. This includes criminals and juvenile delinquents. The most alarming increase, apparently, has been in the number of inmates of benevolent institutions, the range having been from a ratio of 180 in every one hundred thousand of population in 1890 to 355 in 1900, and 433 in 1910. The ratio of the insane decreased during the same period from 188 in every one hundred thousand of population in 1890 to 186 in 1900, but the ratio increased to 204 in 1910. The ratio of the feeble-minded increased from 8.4 in 1890 to 18.6 in 1900, and 22.5 in 1910. The ratio of the blind and deaf increased from 12.2 in every one hundred thousand of population in 1890 to 18.0 in 1900, but diminished to 16.8 in 1910. These figures are not indicative of progress,

moreover they should be accepted with caution. It has to be taken into account that there is a gradual accumulation of inmates on account of a higher recovery rate and a diminished death rate in institutions—for illustration, of the insane and feeble-minded, and to a certain extent the same conclusion applies to prisoners and paupers. The ratio of paupers in institutions diminished from 117 in every one hundred thousand of population in 1890 to 101 in 1900, and 92 in 1910. There was a corresponding diminution in pauper burials, for which the data are available for several large cities. In these cities the average annual pauper burial rate per ten thousand of total population was 28.0 in 1875 and only 9.1 in 1913.

Our judicial statistics are, unfortunately, rather unsatisfactory and inconclusive. The statistics of prisoners, as ascertained by the Census, are fairly trustworthy since 1850. In that year the ratio of prisoners to every one hundred thousand of population was 29.0, which by 1860 had increased to 60.7, by 1870 to 85.3, by 1880 to 116.9, and by 1890 to 131.5. The latest figures are for the year 1910, when the rate was 121.4, but the question may be raised as to whether there has not been an actual increase, when full allowance is made for probable omissions of certain classes of prisoners considered in the previous enumerations. Our statistics of crime, as far as they can be relied upon, indicate that matters have not improved, but rather, to the contrary, that there is a tendency towards an increase in lawlessness, as best indicated perhaps in the statistics of homicides of American cities. Combining the statistics of deaths from homicide for the two cities of Boston and New York, it appears that the rate for 1839–43 was 23 per million of population, and 53 for 1908–12. For thirty American cities during the last thirty years the homicide rate has been 49 per million for the first decade, 49 per million for the second, and 75 per million for the third. There has also been a corresponding increase in the suicide rate, but the figures do not call for detailed discussion.*

*In 1893 the average annual suicide rate in one hundred American cities was 15.3 per one hundred thousand of population, and by 1912 this rate had increased to 18.8. See my Review of the Suicide Record of 1912, in The Spectator, New York, October 2, 1913.

A statistical history of the conditions of labor would make an exceedingly instructive addition to knowledge. Much of the information contained in the documentary history of American industrial society proves the occurrence of at least occasional periods of widespread poverty, unemployment, and discontent. The historical development of our American poor law, commencing with the early colonial period, affords abundant evidence of the existence of much poverty even during a period when the land was practically unsettled, when the cost of the necessaries of life was exceedingly low, and when opportunities for work must have been relatively abundant. The documentary history of American poor relief is exceedingly suggestive of a disorganized state of society, of a public policy of indifference, and an absence of thoroughly well conceived measures of public relief. Reference may be made to an act for the relief of the poor of the city of Philadelphia, published in 1818; a somewhat similar act for the relief and employment of the poor of the city of Philadelphia, published in 1828; a report of a committee appointed at a town meeting of the citizens of the city and county of Philadelphia to consider the subject of the pauper system, in 1827; the report of a similar committee of the Board of Guardians of the poor of the city and districts of Philadelphia, with instructions to visit the cities of Baltimore, New York, Providence, and Salem, published in 1827; a report on poorhouses and jails in New York City, in 1834; and the interesting observations of Theodore Sedgwick in his treatise on public and private economy, published in New York, 1836. I may also refer to the Census of Boston, published in 1845, and the Census of Charleston, published in 1848.* These are but mere indications of a considerable degree of social unrest and economic dependence prevailing at a time when the American Statistical Association came into existence, in 1839; yet even at this early date H. C. Carey, in his Principles of Political Economy, published in 1839, assigned to the United States, in comparison with England, the Netherlands, and France, the first rank in political security,

*An account of some very interesting observations on pauperism and crime. See in this connection my address on "Statistics of Poverty and Pauperism," published in the Proceedings of the National Conference of Charities and Correction for 1907.

the duration of life, the growth of population, the rate of marriage, the rate of fecundity, the condition of morality, power to absorb immigration, and, finally, the efficiency of labor. Giving due weight to all the facts which require consideration in so hazardous a conjecture, it would seem still beyond contradiction that after seventy-five years the United States maintains its preëminence over all other nations of the world in these eight fundamentals of social and economic progress.

All of the foregoing evidences of our material progress are concrete and indisputable, save that in a few directions there has been obviously no advance, but, on the contrary, a retrogression. The evidence is incontrovertible that on the whole there has been measurable progress in the United States in every important direction affecting the material well-being of the people in the sense of Professor Ashley's definition, that to an increasing degree they are provided with more abundant food and, by inference, with better conditions of housing, so as to enable them, if they choose, to lead more healthy and pleasant lives. It has been shown that the production in agriculture and manufactures has considerably increased, and more than proportionately to population, with higher wages, shorter hours of labor, and comparative freedom from demoralizing irregularities of employment. The substantial decline in the death rate from practically all of the recognized preventable diseases, chiefly typhoid and tuberculosis, gives evidence of a material improvement in the average duration of life, which must needs be followed by far-reaching economic results. The shorter hours of labor and the lessened employment of children in industry provide not only more sufficient leisure and opportunity for affection, but also the required amount of rest, recreation, and vacations, as a prerequisite for the maintenance of individual health and physical efficiency. The statistics of education give evidence of the intellectual progress of the nation, which, on the whole, challenges favorable comparison with other civilized countries, more advantageously situated on account of the absence of a large negro and foreign-born population. The statistics of savings banks, building and loan associations, and life insurance companies

and societies give evidence of a wide diffusion of thrift and an increasing equalization in the distribution of wealth, greater per capita undoubtedly in the United States than in any other country of the world. This conception of wealth per capita includes the many forms of intangible wealth, with regard to which there is not sufficient statistical evidence, but as to the existence of which in vast amounts there can be no reasonable question of doubt. This particularly is true of the colossal amounts of mercantile credits, which constitute a large portion of the working capital in small industries and mercantile establishments. It has also been shown by the diminution in mortgage indebtedness of farms and the rising equities in agricultural holdings, that in this country during the last twenty years there has been a measurable and material advance. Additional thereto, it has been shown that the average value of farms has increased out of all proportion to population during the last generation, and it may safely be maintained that there is nowhere today a more prosperous agricultural population than in the United States. Our present growth of population warrants the forecast that fifty years hence we shall number approximately 200,000,000, but even then we shall only have attained a relative density equal to about one fifth of that of the German Empire at the present time.

All this constitutes verifiable and indisputable progress, or possibilities of the nation's future advance in the direction of social and material well-being. The indications of an absence of progress are those of a diminishing merchant marine, than which there is perhaps no more inexplicable phase of our national development, considering the marvelous achievements of American navigation during the period when the nation was in its infancy. That there has been an enormous waste of natural resources is indisputable, but such waste was practically inevitable in a new country of such vast extent as the United States and one making such rapid growth in population. There are, however, also far-reaching compensations for our past failures to husband our natural resources to best advantage, and there has come about a realizing sense of responsibility, reflected in the increasing amount of attention

to the economies of production and the more general utilization of what were heretofore considered the waste products of our industries. Even more regrettable than the evidences of our ruthless exploitation of invaluable natural resources are the obvious evidences of a declining birth rate, a diminishing size of the American family, a rising divorce rate, and an apparent increase in the frequency of lawlessness and crime. These, however, are probably but passing phases of our national existence and the incidental results of a process of readjustment, following our rapid economic advance, on the one hand, and the gradual and only partial absorption of an enormous influx of alien elements from abroad, on the other.

Nowhere in the entire world is there an equal amount of widely diffused material prosperity combined with an equal amount of personal freedom, adequate compensation for services rendered, and leisure time for the enjoyment of the pleasures of life. No equal area in the world affords such a range of opportunity for material advancement of every kind and degree as the United States, from the Arctic shores of Alaska to the semi-tropical island of Porto Rico in the West Indies and the tropical possessions of the nation in the Far East. No one in 1839, when the American Statistical Association came into existence, even though gifted with the most marvelous imagination, could have made a true forecast of the nation's achievements by the year 1914, and it would be equally futile to indulge on this occasion in prophecy, further than that compared with what has been, the future of these United States will unquestionably and by far outdistance all the material, intellectual, and moral achievements of the past. The nation will become more and more a dominating factor in the control of the world's affairs, and its influence will be most profoundly felt in the maintenance of the world's peace. It is largely because of the absence of international strife that the United States is able to look back upon a prolonged and uninterrupted record of advance—advancement with which there is nothing to correspond in the past history of mankind. It is but fitting that in a democracy the gains resulting from such progress should have accrued to the material benefit of

the vast majority of the people, and nowhere, it may be asserted without fear of contradiction, are the toiling masses so conspicuous and effective in their power and control of national affairs as in the United States. The present is a transitional period, fraught with many serious moral, as well as economic problems; but with the assurance of economic well-being and economic security, there will gradually come about a realizing sense of greater personal responsibility and answerableness for the possession of a new freedom which, even more than any concrete material evidence, will visualize the true and enduring advancement of the American people.

RECORDS OF HEALTH AND SANITARY PROGRESS.

By Robert E. Chaddock, Ph.D., *Associate Professor of Statistics, Columbia University.*

Health and safety have not been the fundamental considerations in locating and building our cities. Population has concentrated in certain centers because they were favorable for productive enterprises or mercantile operations. These communities may be swept by flood or earthquake and they are rebuilt in an incredibly short time. Bad housing and sanitation have cost thousands of lives each year, but the tide of population is not turned back from the city. Bad working conditions are responsible for scores of thousands of crippled and inefficient workers and yet the laborers continue to submit themselves to the dangerous conditions. The desire for economic advantage has made some forgetful and others reckless of human welfare and individual happiness. The pressure of economic necessity has prevented many from asserting their rights to better living and working conditions. Ignorance of the facts has kept silent many who would otherwise have protested.

The city should know more about itself. If it is to become more than a labor market and place of business; if it is to be made a healthy and comfortable place in which to live as well as to work, more exact data should be recorded concerning the bad effects of certain city conditions upon the health and welfare of the urban population. A great advance in this sort of knowledge already has been made. Such information is leading to a policy of city planning instead of allowing cities to grow up haphazard. Every addition to our knowledge reveals the lack of proper adjustment, the existence of selfish exploitation and the absence of coöperation for the common welfare.

A scientific laboratory is a place where observations are made and recorded; where the conditions of an experiment are carefully arranged and the results noted; where the relations of cause and effect are investigated. There is a sense

in which the city may serve as a health laboratory. Observation and analysis of the phenomena as we find them may reveal relations of cause and effect which are of the greatest significance in community action for the common welfare. The term "survey," recently applied to the effort of a community to find out the facts about itself, emphasizes the same viewpoint.

One of the most active health campaigns is directed against the high infant death rate. Miss Julia C. Lathrop, chief of the Children's Bureau, finds that 42 per cent. of the babies dying within the first year of life die within the first month.* Of this number about seven tenths die, according to the same authority, as a result of conditions existing before they were born or as a result of injury or accident at birth. How much of this high mortality may rightly be attributed to the work of the mother and her working environment, or to long hours of work up to the time of childbirth? How many health departments attempt to relate infant deaths to the work of the mother? A special investigation recently made by agents of the Bureau of Labor presents data on this problem for Fall River and certain other Massachusetts towns,† but there is need of a constant and widespread analysis of the infant deaths in every city according to the occupation of the mother and her hours of work. How else can it be determined what legislation is needed providing for a period of cessation from work before and after childbirth and for the regulation of employments dangerous to the health of the mothers of the generation yet unborn?

Dr. Watson S. Rankin, Secretary of the North Carolina Board of Health, tells of a town in his state which had required a railroad to build an overhead bridge at a cost of $18,000 because, during a period of ten years, ten fatal accidents had occurred at that crossing. The interest on the original cost of the bridge plus the annual wear and tear would amount to at least $1,500 per year. This sum the company was compelled to pay each year to save one needless death. The authorities of this town of 4,000 population were spending

* Prenatal Care, Publication No. 4, United States Children's Bureau, Washington, D. C. 1913, p. 5.

† Report on Condition of Women and Child Wage-Earners in the United States, Sen. Doc. 645, Vol. 13, 61st Cong., 2nd Sess., 1912.

$150 annually in their health administration. A visit to their registrar of vital statistics showed how many needless deaths from various causes had been occurring each year. The general death rate was 27.5 per 1,000 population, which was 12.5 persons in each thousand higher than the rate for the average community. Therefore, about fifty lives were being needlessly sacrificed each year. Their death rate from tuberculosis was twice the average and from typhoid more than seven times the average. This was a sick town, but it was unconscious of the real health situation, and, therefore, inconsistent in measures for health preservation.*

The discovery of the typhoid bacillus and the knowledge of its mode of entrance into and its exit from the body has led to the recognition that typhoid fever is a preventable disease. In theory, it is possible to eradicate this disease completely by protecting food and water from all contamination and by the destruction of all typhoid germs excreted from the body. The degree of success with which this knowledge has been applied varies greatly in European and American cities. The typhoid death rate per 100,000 of population in Paris, in 1910, was 6.7; in Vienna 4.1; in London 4.0; in Berlin 3.6, and in Hamburg 2.5. These and other European figures show an average mortality from typhoid of about 4 per 100,000. The showing of the cities of 100,000 and over in the United States in comparison is not flattering. Of the fifty such cities in 1910 only four showed a typhoid rate of 9.5 per 100,000 or less, while nine of these cities exceeded 40 deaths per 100,000 of population. The average rate for the fifty cities was 25 deaths per 100,000, about six times the European rate.† Evidently, there are many difficulties in the campaign of prevention to be carefully analyzed and wisely solved in this country.

The Utility of Vital Records.

If we would secure better statistics of births, deaths, and sickness, it is necessary to show for what purposes they may be used.

* The Influence of Vital Statistics on Longevity, W. S. Rankin, The American Underwriter, January, 1913, pp. 2–3.

† Monthly Bulletin of the State Board of Health of Massachusetts, February, 1913, pp. 57–59.

(1) *Vital statistics are the bookkeeping of the health movement.* Population is added to by births and subtracted from by deaths. Sickness and disability data measure the possible efficiency of the existing population. Whatever affects either births or deaths, conditions the very existence of the population. That which causes sickness and disability conditions efficiency and happiness. By reducing the death rate the healthy increase of the population may be maintained with a lower birth rate and without the burdens connected with the rearing of children and with sickness and death.

Too often the profit and loss account of a business firm has kept no record of the human wear and tear or of the human gains of certain business policies. Vital records should supply this neglected information. Laws may make it to the financial interest of the employer to count these human wastes and to prevent them. At present we must depend upon estimates of how many fatal accidents and non-fatal injuries occur in industry each year, or how many workers in lead or other dangerous substances are poisoned. Why should a probable annual toll of 30,000 fatal accidents in industry in the United States or of 2,000,000 non-fatal injuries be left to estimate? A careful analysis of facts, conscientiously recorded, would show the effect of the adoption of safety devices or the losses which result from neglect of safety precautions. When the New Haven Railroad has an accident causing the loss of a score of lives, it is made a matter of several public inquiries, with the effort to show the causes and whether the loss of lives might have been prevented. What of the army of laborers who are destroyed or maimed each year in industry? We need to know where and how and why in all these cases in order that the community may be informed of its wastes of human life and efficiency. Even employers themselves need to be shown by a careful record that the removal of dust and poisons from the factory or the protection of the worker from their effects brings about less lost time through the sickness of employees, and enables the worker to turn out more and better products.

Likewise with preventable disease and sickness. We must depend upon the estimate of 150,000 deaths annually from

tuberculosis in the United States and of 500,000 persons continually ill from the same disease.* Analysis of the facts of this disease which causes one tenth of all deaths, and that largely during the productive period from 25 to 45 years of age, must result in fixing responsibility upon housing and working conditions, and upon ignorance. Since the disease is recognized as preventable the records ought to show what methods have yielded the best results in reducing mortality and sickness. The measure of success or failure of preventive work is found in vital statistics.

It is estimated that 300,000 babies in the United States died last year before they were one year old.† The records of this appalling waste of infant life, carefully analyzed, ought to show the causes and make clear the lines of preventive activity. No business firm would dare to be as careless of raw material and mechanical equipment as our communities have been of life and health. No one can estimate the poverty and misery which result from such neglect. There is the greatest need for careful community records of the human losses and gains in the struggle for progress.

Birth statistics are less accurately collected in most of our states than deaths, but the immediate public record of a child's birth is of absolute importance to the health authorities. In case the family cannot afford adequate medical and nursing care aid may be furnished at once to mother and child. New York City employs the school nurses during the summer in the campaign against infant mortality in addition to the regular staff of infant nurses. A number of infants are assigned to each nurse, whose duty it is to visit the homes and instruct the mothers on the care of the babies and to secure medical and other care where needed. Obviously, this method of work, whether by municipal or volunteer agencies, is greatly facilitated by early and complete registration of births.

(2) *Vital statistics show us where to look for bad health conditions and demonstrate the success or failure of a new health policy when adopted.* To the health official and investigator

*Report on National Vitality, Irving Fisher, Bulletin 30 of the Committee of One Hundred on National Health, 1909.

† Prenatal Care, op. cit., p. 5.

they serve the same purpose as symptoms to the physician. To the sanitarian they are what chart and compass are to the navigator. Arthur Newsholme, the English statistician, declares that modern sanitary science owes its existence to the registration of deaths and their causes. Frederick L. Hoffman maintains that vital statistics alone furnish a definite measure of the value of sanitary improvement and the progress of medicine and surgery.

In 1907 the typhoid death rate of Pittsburgh was 130.8 per 100,000 of population, which showed criminal neglect by the community in the face of sanitary knowledge. The following year showed a rate of only 46.6—after a filter plant had been installed. The further extension of the use of filtered water and the better enforcement of other sanitary provisions reduced the rate to 25.9 in 1911.* Thus, within a period of four years, the rate had been reduced four fifths, and in the single year of 1911 over 500 lives were saved which would have been needlessly sacrificed to this one disease if the old rate of 1907 had prevailed. This sort of record-keeping convinces the community that a specific health policy is worth while. It demonstrates to the health department itself, by comparison with the results of other policies, the most effective method of saving lives and preserving health.

The last four summers have been noteworthy in the health movement in New York and other cities because of the success of certain plans for the reduction of infant deaths. Milk depots were opened, either under the direction of private associations or the health authorities, nurses and doctors were detailed to give instruction to the mothers and to care for the babies both at the stations and in the homes. The careful weekly record of the vital facts during the dangerous months of mid-summer tell a story of success and measure the extent of it by comparison with preceding efforts. The wisdom of this form of effort and expenditure has been demonstrated. The belief that ignorance is fundamental in the infant mortality problem has been demonstrated beyond a doubt.

It has been shown that the method of feeding is an important element in the infant problem, yet, no health department, so

* Annual Report of the Dept. of Public Health, Pittsburgh, Pa., 1911–[illegible]12, p. 56.

far as the writer is informed, attempts regularly to correlate infant deaths with the method of feeding. The facts of this relationship are essential in an educational campaign among the mothers in the effort to reduce mortality. Dr. William H. Davis, Vital Statistician of the Boston Health Department, has conducted a special investigation in Boston, the results of which were presented at the International Congress on Hygiene at Washington in September, 1912.* One of the chief objects of milk-station and home instruction of mothers before childbirth is to cause more mothers to nurse their babies and better prepare them for doing so. If we are to measure the effectiveness of this method, we should collect the information as to the method of feeding in the case of each infant death, as a test of the educational and prenatal work. The dangers of the artificial food supply of the infant are connected with the ignorance of sanitation and with the bad living conditions amid which so many of the poorer classes rear their children.

(3) *Vital statistics may be related to other social phenomena such as occupation, housing, and nationality.* To analyze this relationship often points the way for an effective preventive campaign. What answer can most health departments give to the question of the relative morbidity and mortality from specific causes in different occupations? Yet, the occupation is recorded on the death certificate and many of our communities are carefully registering and supervising cases of tuberculosis. We find the insurance company making a detailed analysis of deaths by occupation because it is in the interest of its business to measure the variety of risks involved in different occupations. Such an analysis by the Prudential Insurance Company is shown in the following table:

* Transactions of the Fifteenth International Congress on Hygiene and Demography, Washington, D. C., 1912, Vol. 6, pp. 184–190.

PROPORTIONATE MORTALITY BY CAUSES AND OCCUPATIONS, AGE 15 AND OVER. PRUDENTIAL INSURANCE COMPANY, 1907-1910.a

Cause of death.	All Occupied Males.	Farmers.	Clerks.	Coal Miners.	Iron and Steel Workers.	Carpenters.	Painters.	Plumbers.	Printers.
Typhoid	1.8	1.3	3.0	2.0	2.2	1.0	1.3	2.5	2.3
Alcoholism	1.5	.3	.8	.6	1.0	1.1	1.4	1.9	1.6
Cancer	4.3	6.1	2.1	2.7	4.6	5.7	3.4	3.4	2.4
Tuberculosis	21.9	10.2	36.7	11.1	19.4	16.1	23.8	32.9	38.4
Old age	.9	2.9	.2	.2	.8	1.4	.6	.1	.1
Apoplexy and paralysis	7.8	14.6	4.6	6.1	7.1	10.9	8.4	4.7	4.1
Other nervous diseases	2.7	2.5	3.5	1.6	2.9	2.7	2.3	3.2	3.0
Heart diseases	9.2	12.7	7.9	6.8	8.8	11.4	8.1	5.2	10.0
Pneumonia	8.9	8.3	8.1	11.4	9.7	7.8	7.4	7.7	8.1
Other respiratory diseases	3.4	3.6	2.2	9.3	2.8	3.3	2.5	1.7	2.6
Liver diseases	2.9	2.1	2.2	2.5	2.3	2.5	2.7	2.6	3.2
Other digestive diseases	4.1	4.9	4.3	3.9	4.6	4.3	3.7	4.5	3.8
Urinary diseases	12.0	12.9	9.6	8.0	9.9	13.4	15.1	11.1	8.9
Accidents	9.3	5.8	6.7	22.9	15.3	7.8	8.6	11.7	5.7
Suicide	2.2	1.6	1.9	.9	1.8	2.7	2.9	1.9	2.0
Lead poisoning	.1	.....	.....	.....	.....	.....	1.5	.....	.....
All other causes	7.1	10.2	6.5	10.1	6.8	8.0	6.5	5.0	3.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

a Exhibits of the Prudential Insurance Company at Fifteenth International Congress on Hygiene and Demography, Washington, D. C., 1912 (Compiled). Percentages copied as in the original but they do not always add to 100.0%.

A glance at the above table* reveals a widely different mortality for different occupations from such causes as tuberculosis, urinary diseases, and accidents. This is preliminary information to the discovery of why mortality is high from specific causes in certain occupations. We need constant analysis of all mortality returns and cases of reported illness by occupation. Regulation of conditions which destroy health and sacrifice lives will surely follow. Special inquiries, such as that recently made in Illinois by Dr. Alice Hamilton or in New York State by the Factory Investigating Commission, to discover the nature and extent of lead poisoning in industry, are not adequate.†

The report of the New York Congestion Committee‡ and special studies on housing made in Chicago§ and Boston‖ emphasize the close relationship between housing and health.

*To bring out the real significance of these figures the deaths must be analyzed by divisional periods of life. This the Insurance Company has done in each occupation.

† Preliminary Report of the Factory Investigating Commission of New York State, 1912, Vol. I, Appendix VI.

‡ Report of the New York City Commission on Congestion of Population, 1911.

§ American Journal of Sociology, September, 1910, to September, 1911.

‖ Report of the Homestead Commission of Massachusetts, Boston, 1913.

It is admitted that crowding has a vital relation to the problems of tuberculosis and infant deaths. But how many cities have any exact and continuous data as to the extent of room-crowding and its relation to the death rate? The numbers living per acre in various sections are not comparable because no account is taken of the part of the area devoted to other purposes than residence or of the varying heights of dwellings. Therefore, we have not the data to measure the influence of congestion upon health with even an approach to accuracy. Yet, only by measuring the bad effects of the city environment upon the people who dwell there will the movement for city planning secure its effective motive power and justify, in the eyes of those unaffected by artistic motives, the large expenditures needed to make the city a healthy place in which to live.

Mortality and morbidity rates vary among different nationalities. For instance, the infant mortality and tuberculosis rates are much lower among the crowded Hebrew population of the lower East Side in New York than on the much less crowded West Side where different nationalities dwell.* A large proportion of our immigrant population is coming into a city environment which is utterly different from that to which they have been accustomed. Ignorance is the most serious menace to their health. Urban conditions become especially dangerous in this situation. For this reason it is very important that sickness and mortality data be analyzed by nationality and specific causes. Year by year the cases of reported illness and the deaths from tuberculosis among the foreign-born and those of foreign descent should be correlated with the number of years spent in this country, in order to measure how the new environment registers its effects upon the health of the immigrant. Knowledge of the facts would lead more surely to wise provisions to control the disease before it has gained too strong a foothold, including an educational policy to aid adjustment in the new surroundings. In northern cities the death rate of the colored race from tuberculosis is two or three times the rate for whites. Adjustment to the city life is not successful and the race would die out if not recruited constantly from the South. Employment is

* The Waste of Infant Life, Edward T. Devine, Survey, December 4, 1909.

intermittent, housing conditions are bad, incomes are low, and rents are high. There is complete ignorance of sanitary precautions. Therefore, the race has fallen a victim to tuberculosis. It is a menace to the health of the community to neglect the health of any part of its population. The effects of city conditions should be measured and then such policies may be adopted as will counteract the bad effects and promote the good influences.

(4) *Vital statistics have a most important practical bearing upon the problems of widows' pensions and minimum wage.* It may be expedient to grant pensions to widows but it is not a complete solution. If granting such pensions should lead the community to believe that by so doing it had fulfilled its entire responsibility the plan would be an unmitigated evil. A fundamental inquiry is not as to how much the widow needs from the state, but how she comes to be in need at all. At the critical period when a family was being reared did some fatal accident or preventable disease deprive the family of its natural support? If so, the logical solution is to prevent these dangers to life and health, so far as possible, and to meet by a system of social insurance the burdens which cannot be avoided. Upon such observation and knowledge is preventive work based, and a solution worked out in this manner becomes permanent.

The minimum wage idea is in danger of being regarded as a panacea for the ills of low wages. It may be expedient to have a minimum wage for certain work but the law will not endow those of low earning capacity with higher earning power. Too many are not earning more than they receive. A fundamental inquiry must not be forgotten—why are wages low? The minimum wage legislation may prove a good method of bringing into view the group with low earning power. It will then be possible to observe and measure more accurately the results of accident and disease and fatigue in decreasing earning ability, the effects of working too early in life or under bad working conditions in shortening the working life, as well as many other causes of low wages. The community will then be in a position to remedy these various causes whose combined effects are low wages.

(5) *Vital statistics make possible the wise and efficient administration of a health department.* "Public health is purchasable" reads the motto of the *Monthly Bulletin* of the Department of Health of the City of New York. Following this idea the city spends several million dollars each year in its health administration. This is a big business undertaking. The object of every health department should be to secure as large a return in lives and health as possible for a given expenditure.

The head of a business firm asks of his bookkeeper more than a statement of general results. He wishes to know what lines of effort have yielded the best returns and what, if any, have been conducted at a loss. He wishes to know the weak spots in his system of business administration in order that efforts may be concentrated at those points. Likewise, the health department of a city should ask of its bookkeeping division—the bureau of vital statistics—what causes of death are increasing and what are decreasing both in the community as a whole and in particular smaller localities? What occupations are so dangerous to health as to require regulations for the protection of the employees? In what sections of the city, among what nationality, or under what sort of industrial and living conditions is the mortality of infants high? Does the crowding in a certain area, as measured by the number of persons per room, result in a higher death rate? What is the relation of the milk supply to health? What effect has the milk station upon health? What trades are especially dangerous from the point of view of tuberculosis? Is one nationality more susceptible than another? Are the housing conditions in certain areas especially responsible for the high rate in those districts? How much lower is the rate where hospitals and sanatoria have been provided for dangerous cases, and where nursing and instruction are given in the homes? Most of these questions are not adequately answered by data collected and analyzed by the city bureaus of vital statistics. Without such information the health department is not in a position to expend its money and energy to the best advantage in preserving health.

These facts are also needed to educate the public in the health needs of the community in order that they will indorse more adequate appropriation of funds for the health department. The educational function of vital statistics, properly presented, is most important in the preventive work, where not only must the individual be made to understand the common dangers to which he is exposed, but also that he has a right, in coöperation with others, to demand protection through community agencies, such as the health department and building department of the city. The public must be brought to realize, by seeing the actual figures or a graphic device based on actual figures, to what extent a bad water supply increases the cases of typhoid; how much impure milk raises the infant sickness and death rates; that bad sanitation results in epidemics of diseases; that bad housing increases the cases of tuberculosis; and that too few food inspectors endanger the health of thousands in the community. Then the public will support additional expenditures to improve these conditions. Health departments have just begun to popularize a part of their collected data and to publish it in the form of weekly or monthly bulletins or through the newspapers. The Chicago Health Department is a leader in this form of activity. Within the last year the New York City Health Department has organized a Bureau of Public Health Education. Just as the physicians are more and more taking the community into their confidence by popularizing and publishing information on the nature and prevention of disease, so must health departments widely extend the movement for popular education to enlist coöperation in the preventive work.

The chief hindrance to effective effort in the health departments of most cities is the lack of adequate funds. We have some very significant facts, in the prosperous states of Illinois and New York, as to the compensation paid to the chief health officer in various cities. Dr. Palmer, of Springfield, Ill., reports the results of his inquiry in that state in a paper entitled, "The Shortcomings of Municipal Public Health Administration," published in the *American City* for August, 1911. He ascertained the facts in forty-four Illinois cities of 3,000 population or over. Thirty-six of these cities pay less

than unskilled workman's wages to their chief health officers. Twenty-one of the forty-four cities have no appropriation for public health purposes, or only that for the payment of the nominal salaries of officials. Two cities of over 20,000 population each propose to give health protection at a cost of $300 per year. Twenty-nine of the forty-four cities employ no inspectors at all. While fifteen of these cities exceed 20,000 in population and three are over 50,000, not one city pays sufficient salary to its chief health officer to warrant a competent man in devoting all his time to the work. One city of 59,000 pays $1,500 per year, the highest salary paid to any municipal health officer outside Chicago; a city of 70,000 pays $1,200, and one of 51,000 pays $1,000. The twelve cities paying nothing include one of 30,000, one of 22,000, and one of 21,500 population. How could the health and lives of the people be adequately protected in such a situation?

The Special Health Commission, appointed by Governor Sulzer, and reporting to the New York Legislature last year, revealed about the same situation for the cities of New York State.* The Children's Bureau at Washington, in making inquiry as to activities in various cities of the United States, in the campaign against infant mortality, received this reply from the board of health of a city of 687,029 population, dated February 20, 1913: "I have to advise that the health department has no funds available for organizing a division for the care of infants." Another health officer in a city of over 168,000 said: "We have been unable to get an appropriation from the city council for carrying on a campaign of this kind."† Therefore, it is desirable to accumulate such an array of vital facts, so clearly analyzed and presented, that the truth of the New York Health Department motto will become generally recognized—*that health is purchasable.* Then the appropriations will become more adequate. The public does not look at all or looks in vain among the pages of the average health report for information which will furnish convincing proof or disproof of the efficiency of past policies and which will guide to an intelligent shaping of future policies.

* Governor Sulzer's Message on Public Health with the Report of Special Public Health Commission, Albany, 1913.

† Baby-Saving Campaigns, Publication No. 3, Children's Bureau, Washington, D. C., 1913, p. 11.

IMPORTANCE OF THE UNIT OF AREA IN THE TABULATION OF VITAL STATISTICS.

In most cities, at the present time, deaths and other vital facts are tabulated by political divisions, not by sanitary areas. Moreover, the unit of area is too large. It includes many different kinds of sanitary and housing conditions. For practical or scientific use by the sanitary and health officials it is not sufficient to calculate the death rate for an entire city or even a ward. In one part of the ward or assembly district or borough, health conditions may be very good, in another part the conditions may be very bad. To calculate a rate for the entire area shows nothing that is true, for it does not represent either the good or the bad part of the area. And yet, most of our cities publish the tabulations for the entire city or for each borough, or at best by wards.

The general death rate year by year is useful in showing the sum total of success or failure in the efforts to preserve health. The general death rates of two cities may be compared and methods successful in one may be adopted in the other with like favorable results in reducing the rate. But, for active operations in a specific community and for an accurate understanding of causes, as preliminary to social action or action by the health officials, the vital facts are needed for narrower areas. The unit should be a sanitary area, not a political or administrative one, as at present in most cities. It should be permanent—which political areas are not—in order that frequent comparisons may reveal changes in health facts connected with changes in nationality, sanitation, housing, intelligence, and other social conditions. This comparison may reveal the operation of causes. It should be small enough to be relatively homogeneous in the chief conditions which affect health but not so small as to be inaccurate for statistical purposes. Most tables of vital statistics, as at present published by city health departments, are utterly inadequate as a guide for social action and are of little use for scientific purposes.

There is need of a research bureau in connection with the department of vital statistics whose function should be to tabulate the vital facts by smaller areas and make the significant correlations and comparisons. What the health guardians

of a community wish to know is not the infant mortality rate of a whole borough or ward, but in what sections of the city is the rate high, what is the condition of the milk supply in that section, the sanitation, the housing, the intelligence and income of the families, the working conditions of the mother, if she works. Knowing these facts for separate smaller areas and comparing them may show very clearly the causes at work to produce either a high rate or a low rate of infant mortality. In some sections milk stations will then be established, with instruction of mothers and medical care of babies, the milk supply will be better guarded, and the sanitation improved. The result will be observed and the new death rate will show the success or failure of the effort. If the rate were to be calculated for an entire ward or borough, the result of the establishment of milk stations might show in the reduced death rate and yet some very bad health conditions, in certain small sections, still remain concealed by the very good conditions in other sections. Thus, to average results over wide areas with heterogeneous conditions is always dangerous and likely to mislead.

The health official or investigator does not care so much for the death rate from tuberculosis for a borough or an entire city because he wishes to ascertain where the rate is high or low and to find out why. He finds a high death rate from this disease in a section of the city with bad housing, dusty or otherwise dangerous occupations or with inadequate facilities for care of advanced cases, and with this information he is ready to work out a remedy. In this case also if the death rate were calculated over too large an area, the conditions needing remedy might not be revealed but rather concealed by the very good showing of the best sections. Although it is recognized that tuberculosis is an occupational disease, most of our city health departments throw no light, in their published reports, on the relation of deaths to occupation.

The public and the health officials are not interested alone in the contagious disease rate of the entire city, because, while the city may be making a good showing, some section of the city may need a contagious disease hospital very badly. To demonstrate this fact it would be desirable to examine the

sickness and mortality from contagious diseases in smaller areas. This would show the danger spots which really are a peril to the city as a whole. In some sections the population may be so crowded that contagious disease quarantine is difficult to enforce, thus causing the rate to increase. In other sections the people may be engaged in work in their own homes in the tenements and may be endangering the public health through contagion carried by the article manufactured in the home. These are the important facts to be known by the health authorities, and a rate for too large an area will not show the real situation.

There is need for coöperation in making vital statistics most useful. It is clear that, if death and sickness data are collected and tabulated by smaller sanitary areas, the population facts must also be secured by these same areas in order to compute a rate of death or sickness per unit of population. The facts about the housing situation, room-crowding, home work and occupational conditions should also be gathered in these same areas in order that comparisons may be made between mortality and morbidity data and other social and economic facts.

Conclusion.

The present paper has attempted to emphasize the purposes for which good vital statistics may be utilized and the results to which they may be expected to contribute their part. Many of the present defects have been pointed out with the idea of indicating how much more effective such facts might be made if properly collected and tabulated and presented to a wider group of citizens, as well as to the health officials themselves. The need for more intensive study over smaller areas of the facts concerning sickness, death, and disability has become imperative for health departments, especially those of the larger cities where conditions are so complex, in order that effort and funds may be concentrated where they are most needed and where they will yield the largest returns in the preservation of health and efficiency and in the promotion of independence and welfare. The public must be educated in health problems by the facts made intelligible to them in order that their coöperation in the health movement may be assured.

SOME CENSUS PUBLICATIONS AND CENSUS METHODS.

By Edward M. Hartwell, Ph.D., *Municipal Statistician, Boston, Mass.*

Speaking broadly, the statistical publications of the United States Government are repositories of information in bulk, placed in store for the benefit of such inquirers as may be skillful and patient enough to extract special data from them. They resemble stacks of pig-metal rather than packages of finished cutlery of assorted sizes, completely adapted to meet the demands of a diversified retail trade comprising skilled mechanics, as well as lumbermen and good housekeepers.

In comparison with State and Municipal statistical publications, those of the Federal Government conform more nearly to the state of the art as regards intelligible and helpful methods of tabular presentation, although there is abundant room for improvement in many volumes issued from the Government Printing Office at Washington.

Having frequent occasion to compile tables to meet the demands of individual inquirers as to the comparative standing of selected specimens of the most populous cities of the country, in particular respects, *e. g.*, taxable basis, corporate assets, tax levy, debt, industrial activities, financial resources, etc., I find the publications of the Bureau of the Census to be indispensable, and am abundantly grateful for benefits derived and derivable from their stores of information.

I am inclined to consider the Bureau of the Census as the central luminary in the statistical firmament of the country. But recent observations impel me to call attention to what appear to be an increasing number of spots displayed by that Sun. What follows is offered in the hope that such spots may ultimately grow so dim that the face of our chief luminary may appear immaculate to the *illuminati* as well as to the man in the street.

If one attempts to compile a table from the Bulletins for 1912 and 1913 of the Bureau of the Census, entitled Financial

Statistics of Cities, to show the relative standing of the ten most populous cities of the United States, as regards taxable basis, receipts, payments, debt, etc., he will find himself obliged to insert the selfsame figures under certain rubrics for both years, in seven out of the ten cities, or to abandon the attempt. Having occasion to construct a table on the lines indicated, I was obliged regretfully to fall back on a newspaper Almanac for data regarding the year 1913.

If the Bulletin for 1913 contains any *caveat lector*, it has escaped my notice. The nearest approach to such a warning appears to be the following statement in the Introduction to the Bulletin for 1913, on page 7:

> The statistics in this bulletin all relate to fiscal years ending between July 1, 1912, and June 30, 1913, except for certain independent divisions and funds of cities, in which the fiscal years of the city corporations closed between July 1, 1912, and January 31, 1913.

The foregoing statement, although it does not say so in terms, marks a change from previous years in the period covered by the tables presented for 1913. The nature of the change becomes evident on comparing the following extracts from the Financial Statistics of Cities for 1912 and 1911 respectively:

> The statistics shown in this report relate in each case to the fiscal year ending between February 1, 1912, and January 31, 1913.
>
> These statistics pertain to the fiscal year of each municipality, and of each division and fund thereof, closing between February 1, 1911, and January 31, 1912, as shown in detail in Table 23.

In the Bulletin for 1913, data for 199 cities of 30,000 inhabitants or over, are tabulated, against 195 cities in 1912.

In 120 cities, or 60.3 per cent. of those embraced in the Bulletin for 1913, the fiscal year ended within the period August 31–December 31, 1912, while in 79 cities, or 39.7 per cent., the end of the fiscal year fell in the period January 23–June 30, 1913.

The most frequent date of the end of the fiscal year was December 31, 1912, in 102 cases, or 51.3 per cent. of all cases.

The next most frequent date was June 30, 1913, of which there were 23 cases, or 11.6 per cent.

SUMMARY.

1913—Jan.–March,	there were	28 cases, or	14.1 per cent.
Apr.–June,	there were	51 cases, or	25.6 per cent.
1913,	there were	79 cases, or	39.7 per cent.
1912, Aug.–Dec.	there were	120 cases, or	60.3 per cent.
Total		199 cases, or	100.0 per cent.

In the 195 cities embraced in the Bulletin for 1912, the end of the fiscal year fell within the period February 29–December 31, 1912 in 189 cases, or 96.9 per cent. of all cases; the residue, viz., 6 cases, or 3.1 per cent., fell in January, 1913; in 5 cases it was in January 31.

As in 1913, so in 1912, the most frequent date of ending was December 31, in the case of 100 cities, or 51.3 per cent., and the next most frequent date was June 30, comprising 22 cases, or 11.3 per cent.

Summarizing the ending dates of the fiscal years for the 195 cities entered in the Bulletin for 1912, gives the following:

END OF FISCAL YEAR—FELL IN:

1912—Jan.–March,	in 21 cases, or	10.8 per cent.
Apr.–June,	in 49 cases, or	25.1 per cent.
July–Sept.,	in 8 cases, or	4.1 per cent.
Oct.,–Dec.,	in 111 cases, or	56.9 per cent.
In 1912,	in 189 cases, or	96.9 per cent.
In 1913,	in 6 cases, or	3.1 per cent.
Total	in 195 cases, or	100.0 per cent.

The present Director of the Census instituted the issuance of an abridgment of the Annual Report on the Financial Statistics of Cities "in accordance with the recommendation of several statistical experts appointed to devise methods of hastening the publication . . . of such annual reports as are prepared by this bureau."*

So we have Bulletin 118, and the Eleventh Annual Report relating to the financial statistics of cities for 1912, and Bul-

* See letter of transmittal of the Director, December 15, 1913, *ibidem* July 30, 1914.

letin 126 for 1913, with the twelfth report to follow, it may be supposed.

Whether the change of year embodied in Bulletin 126 (which consists largely of identical figures contained in Bulletin 118) was recommended by the several experts alluded to by the Director (see above) does not appear. If it was, it would seem that an extraordinary fondness for June 30, the end of the fiscal year of the Federal Government, must have blinded the experts aforesaid to the effects of a change, which has resulted in precluding the possibility of making correct comparisons in respect to the financial standing of very many cities for the years 1912 and 1913, unless the supposedly forthcoming twelfth report should be constructed on a different basis from Bulletin 126.

Hastened publications, prepared to meet the supposed needs of impatient inquirers, unless they are provided with fingerposts to indicate pitfalls, may, if persistently put forth, cause even the elect to stigmatize the Financial Statistics of Cities as misleading, to say the least.

Let us mark and digest a few of the most striking results of: (1) inserting identical total fiscal figures in corresponding tables for 1912 and 1913; and (2) computing per capita averages for two successive years by dividing identical dividends by two different divisors, viz. (a) the estimated population as of July 1, 1912; and (b) the estimated population as of July 1, 1913.

The Assessed Valuation of Property in New York, in Table 1, page 19, Bulletin 118, is given as $9,177,495,629 for the year ending December 31, 1912. In the corresponding table in Bulletin 126, the entry is repeated figure for figure. But different per capita figures are given, viz., $30.72 in Bulletin 118, and $29.92 in Bulletin 126, the estimated population used in computing the former being 5,064,237 for 1912, and 5,198,888 for 1913.

The same procedure is carried out, not only as regards Assessed Valuation, but as regards Property Taxes, Receipts during the Year, Payments during the Year, Indebtedness at End of the Year, etc., in the case of Chicago, Philadelphia, Cleveland, Baltimore, and Pittsburgh, whose fiscal

year ended on December 31, 1912, and of Boston, whose year ended January 31, 1913. In only three cases do the absolute figures in the two bulletins differ consistently; to wit, for St. Louis, with its fiscal year ending April 8, 1912, and April 7, 1913; Detroit, with its fiscal year ending June 30, in both years; and Buffalo, with its fiscal year ending June 30, in both years. The population estimates differ correctly for the years 1912 and 1913 for each of the three cities.

The result is that the comparative per capita averages, and there are scores of them, are incomparable for all of the ten cities, excepting St. Louis, Detroit and Buffalo for the years in question.

Bulletin 126, for 1913, contains financial statistics for 199 cities. As regards 122 of them, or 62.6 per cent., the assessed valuation figures are identically the same as those printed in Bulletin 118, for 1912; while in 73 cases such figures differ. So the per capita averages of taxable basis, for any of the 122 cities, as set forth in the tables for 1912 and 1913 respectively, are not comparable with each other, although the divisors, *i. e.*, the population, estimated as of July 1, for 1912 and 1913, differ; since the dividends are the same for both years. Although I have not subjected all the per capita averages, as to taxes, receipts, etc., to the test applied to each of the 122 cities in respect to assessed valuation, in no less than 73 out of 100 instances which have been tested at random, the comparability of the published per capita averages is invalidated.

It may be remarked, in passing, that comparison of the Seventh and Eighth Reports on Financial Statistics of Cities, viz., for 1908 and 1909, discloses the fact that for 53 out of 158 cities included in the two reports, the valuation figures for individual cities in 1909 and 1908 are identically the same, and yield incomparable per capita averages for the two years, because their divisors, *i. e.*, the estimated population, viz., as of June 1, differ for the year in question.

The report for 1909 (see page 26) states that "The Statistics in this report refer to the fiscal year of each city, and of each division, fund, and account of the city, closing between February 1, 1909, and January 31, 1910"; but the reader is not notified that a change from the method of classifying the fiscal

years in the reports for the years 1902–1908 inclusive is signalized by the aforesaid statement!

Manifestly, the Report for 1909, contains, as does the Bulletin for 1913, a mass, or perhaps mess is the more descriptive word, of misleading per capita averages.

A predilection for per capita averages is a marked characteristic of the ultimate consumer of comparative municipal statistics. Is it well that he should gorge himself on thistles under the impression that he is munching grapes?

In the Report for 1902, on Financial Statistics of Cities, we find the following:

> According to the Bureau of the Census, the fiscal year 1902 is, in general, the one having six or more months in the calendar year 1902, and thus most nearly coincident therewith. The data secured by the Bureau of the Census for each department and branch of municipal government are for a fiscal year shown as such in the local reports and records.

The statistics for 1902 and 1903 were issued in one volume. The statistics for 1902 and 1903 related to cities having 25,000 inhabitants or over; but those for 1904, related—as has every subsequent report and bulletin—to cities with a population of 30,000 or over.

From 1902 to 1908, inclusive, the Bureau of the Census consistently adhered to the definition of the fiscal year just quoted from the Report for 1902. Inspection of the reports shows that the earliest ending of the fiscal year throughout the period, *i. e.*, for seven years, was July 31, 1902, 1903, etc., and that the latest ending fell on June 30, 1903, 1904, etc.

In the period 1909–1912 inclusive, the fiscal years covered by the reports closed between February 1 of the year for which the report was issued, and January 31 in the succeeding year, *e. g.*, February 1, 1910–January 31, 1911. The change in 1913 was tantamount to a return to the method followed in the period 1902–1908.

In the period 1902–1909, population was estimated as of June 1 in the year covered by the report. For 1910, the population enumerated as of April 15, 1910, was used. Since 1910, the population has been estimated as of July 1, for the year covered by the report.

The result of using three different kinds of population figures as divisors, and of using two different methods of fixing the fiscal year in determining the dividend in computing per capita averages, in the period 1902–1913, renders it necessary for one who seeks to compare the financial standing of a given city or a group of cities, by years, for the whole or a part of the period, on the basis of the published per capita averages, to exercise exemplary caution and patience, even when the fiscal year of a given city remained unchanged as has usually been the case.

The value of the per capita averages as to valuation, payments, debt, etc., might be considerably enhanced if the figure for estimated population were estimated for a median date in the fiscal year of each city included in the tables. Then if the dividend figures for that year were accurately stated, the resulting per capita averages would be comparable with the corresponding averages from year to year.

A comparison of per capita debt figures by years for Philadelphia in the years 1910–1912, brought out the following figures for Net Debt:

1910.....$55.56 per capita.
1911..... 43.08 per capita.
1912..... 60.64 per capita.

The variation appeared to be too violent, and led to an attempt to test the figures. Computation of the per capita net debt of Philadelphia, using Philadelphia's estimated population for 1911 as the divisor and its net debt as dividend, gave $61.22, whereas $43.08 proved to be the quotient of Philadelphia's net debt, divided by Chicago's estimated population. It was then a simple matter to correct three other incorrect per capita averages under certain rubrics in the table, which, for convenience, are here embodied in a tabular statement.

PER CAPITA AVERAGES, 1911—PHILADELPHIA.

	As Printed.	Corrected.
Gross Debt.....	$50.88	$72.30
General Departments.....	36.42	51.75
Public Service Enterprises	14.46	20.55
Net Debt.....	43.08	61.22

It is not edifying to be made suspicious as to the accuracy of tables published by the Bureau of the Census, particularly when the printer cannot be made the scape-goat.

In this connection, it seems appropriate to call attention to the careless use of distributive or constituent per cents. that, added together, equal more or less than 100.0. Instances of such carelessness, not to say slovenliness, are not far to seek in the publications of the Bureau of the Census. They occur so frequently that one must often recompute constituent per cents. in order to be certain that they amount to 100.0.

For instance, on page 412, Volume I, of the Thirteenth Census of the United States, Population-Table 44, there are 18 statements of the percentage distribution, by age groups, of Indians, Chinese, and Japanese in the States of California, Oregon, and Washington, that purport to foot up 100.0. On testing the constituent per cents., one finds that there are:

7 cases in which the amount is 100.0
2 cases in which the amount is 100.1
1 case in which the amount is 100.2
5 cases in which the amount is 99.9
3 cases in which the amount is 99.8

18 cases, the range being 99.8–100.2

Again, on page 273, Table 21, Volume VII, Manufactures, Thirteenth Census of the United States, 12 series of per cents. show the "Per Cent. of Distribution of Wage Earners in Manufacturing Industries," by Geographic Divisions. On testing, one finds that in:

5 instances, the per cents. amount to 100.0
1 instance, the per cents. amount to 100.1
1 instance, the per cents. amount to 100.2
5 instances, the per cents. amount to 99.9

Other instances of like nature might be cited, even when the constituent per cents. amounted to over 101.0, but the cases cited corroborate the statement that one who wishes to compile perfect tables from the Census publications must test the data or trust to luck, at least where totalized per cents. are concerned.

REVIEWS AND NOTES.

Graphic Methods of Presenting Facts. By Willard C. Brinton. New York: The Engineering Magazine Co., 1914. 371 pp.

In this work by Mr. Brinton we have for the first time a volume devoted entirely to the discussion of graphic representation. The volume was evidently intended more for the uses of the executives of large business concerns who wish to know at a moment's notice the trend of business or costs than for the student of statistical methods.

The author evidently believes that every chart should tell its story entirely unaccompanied by analysis or text, giving the figures from which the chart was constructed. Wherever a chart alone is used for purposes of display in an exhibition it is but natural that the figures must be found on the chart if at all. Where a chart is used, however, upon one page of a book and upon the adjoining page is given the statistics from which the chart is drawn, it is not necessary that the actual figures should, in every case, be found upon the chart. In such cases the chart is used rather to bring out striking changes, or to aid one who is simply interested in the general movement, aside from the actual figures which serve as a basis for the chart. There are over 250 diagrams represented in the volume and the criticism attached to many of them by the author is that the actual figures should have been given on the chart. If the figures along the base line refer to years and upon the vertical axis refer to quantities and a simple dynamic chart is constructed, it is usual to allow the reader to form a close approximation of the magnitude of the variable at each year by referring to the scale at the left of the chart without including also the actual figures at the top of the chart. Where no text is used this method of including the figures in the chart may be advisable, but in the average work dealing with statistics the figures are given in a column for those students who desire them and then the general trend of the figures is shown on the chart. In cases where the statistical tables are included this would seem to be sufficient.

In Figure 144 the author takes decided exception to the method of chart used by the United States Census Bureau in distributing the population by sex, age, and marital condition. He constructs in Figure 145 the chart which he considers to be preferable. It is doubtless true that Chart 144 is exaggerated in that the same space is given to five years as to ten or fifteen years but with this correction it is doubtful whether the form suggested by the author is preferable to that used by the Bureau of the Census.

The chapter devoted to maps and pins is, perhaps, as satisfactory as any in the volume in that it gives various methods for overcoming difficulties which have confronted one who has ever tried to use this method of presenting frequency. The fifty pages of the book devoted to the presentation of charts for the use of the executive of a large corporation should prove of great value to the statisticians of these companies.

One of the best features of the book is the introduction of charts covering a vast range of subjects and the detailed criticism of these charts. In many cases charts have been drawn to show the way in which the material might have been presented in a more satisfactory manner. The page is large but this is necessary in order that the charts may not be too much reduced in reproduction. It was, perhaps, necessary that the paper should be of the quality used in this book but it is unfortunate that the result has been to make the book so heavy that it is not easy to hold for continuous reading.

It seems to be the intention of the author that many of the rules given for graphic representation should be adopted as standards. Most of them might well be adopted, but to a few of them some objection might be made. The warnings to inexperienced workers in this field deserve careful attention. Considered as a whole the author has done a satisfactory piece of work and one for which statisticians will be grateful. The book deserves reading by any one who is intending to use graphic representation, and if the rules given by the author were followed the principal mistakes which are so often made would be avoided.

WM. B. BAILEY.

The Construction of Mortality and Sickness Tables. A primer by W. Palin Elderton and Richard C. Fippard. London: Adam and Charles New York: The Macmillan Co. 120 pp. Eighty cents.

This little book is intended to serve the same purpose in its field as "The Primer of Statistics" published by W. Palin Elderton and Ethel M. Elderton. It gives in language which can be understood by the average student the different methods of computing mortality and sickness tables. In a very few cases the algebraic formulæ are given in a footnote. The methods of computing tables both from the material collected from the experience of insurance companies and also from censuses and death records are given. In the concluding chapter the rates are included from the early Northampton table down to those which show present experience. The volume should be valuable as a first book for those who are intending to become actuaries as well as for the general students of statistics who wish to become acquainted with the process involved in the construction of mortality tables.

W. B. B.

NOTE.

In his review of my "Money and Prices" in the March number of the QUARTERLY PUBLICATIONS, Professor Warren M. Persons makes several serious errors. In the first place, he confuses the arithmetic operations of addition and multiplication in a most surprising way. I had criticized the Pearsonian Coefficient of Correlation as a means for testing the relationship between two series of index numbers, because the coefficient is not changed if a constant is added or subtracted from each term of one (or both) series. Professor Persons admits the fact, but claims that it is an advantage for the Pearsonian Coefficient. He says that it is analogous to moving a curve of index numbers up or down to facilitate comparison. He seems to forget that moving a curve up or down or adding or subtracting a constant from a series of index numbers changes the relationship expressed. We must remember the significance of index numbers. Let us take a series of quantities represented by the index numbers in Column A.

	COLUMN A.	COLUMN B.
1900	100	60
1901	90	50
1902	110	70

The series means that the ratio of the quantity for 1901 to the quantity for 1900 is 90:100 or $\frac{9}{10}$; that the ratio of the quantity for 1902 to the quantity for 1901 is 110:90 or $\frac{11}{9}$. If we subtract 40 from each index number, we get the index numbers in Column B. Now the ratio of the quantity for 1901 to the quantity for 1900 is $\frac{5}{6}$ which is obviously not the same as $\frac{9}{10}$; and the ratio of the quantity for 1902 to that of 1901 is $\frac{7}{5}$ which is obviously not the same as $\frac{11}{9}$. If this fundamental point is grasped the objection to the Pearsonian Coefficient may be stated again. The Pearsonian Coefficient gives perfect correlation when there is a constant difference between the two series of index numbers as well as when there is a constant ratio between the two series. As was shown above, two series of index numbers with a constant difference between them do not display the same relative changes. Professor Persons surely knows the proper method of bringing curves representing index numbers closer for purposes of comparison. Each ordinate of one curve may be multiplied by a constant multiplier, since multiplying both terms of the ratio by the same number does not change the value of the ratio.

Moreover, the above objection applies not only to the ordinary form of the Pearsonian Coefficient of Correlation but also to the modification which Professor Persons intimates might well have been used, namely, Hooker's method. Therefore the use of the method is inadvisable, although it does consider the order in time of the items of the series. Hooker's method uses the differences between the successive items of the series in place of the differences between the items and the mean, in the computation of the coefficient. It is clear that the differences between the successive items of the series would not be changed if a constant were added to or subtracted from each term of the series. So, here again, the coefficient may give incorrect results.

Professor Persons has criticized the Degree of Correspondence without taking the trouble to understand how it is computed and the underlying assumptions. In the first place, the Degree of Correspondence was devised primarily to be used with index numbers. Bearing in mind the nature of index numbers, it seems reasonable to hold that there is perfect correspondence between two series of index numbers if they both move in the same direction and the relative amounts of change are the same. One form of the Degree of Correspondence was used in which account was taken only of the direction of the change and another form (used only in testing the proofs of the Quantity Theory of Money) where both the direction and the amount of the change were considered. This latter form Professor Persons computed incorrectly in his examples. The operation which he describes of making the first terms of the two series equal must be repeated for each pair of terms of the series, and not be done just once for the whole series. Again, the examples by which Professor Persons seeks to show that the Degree of Correspondence is erratic, simply show that he has a different definition of perfect correspondence. He gives series in arithmetic progression or where the absolute changes in one are a given number of times the changes in the other, while, as was shown, the Degree of Correspondence is based on the idea that perfect correspondence means equal relative changes. Professor Persons's idea of perfect correspondence seems to be merely that the relationship between the two series shall be expressible in an algebraic equation of the first degree. He has, of course, as good a right as anyone to make a definition of perfect correspondence. But it is hardly fair to call the Degree of Correspondence, based on another idea of perfect correspondence, erratic, simply because it does not fit his definition. In the case of all the examples given on page 81 of the review, the Degree of Correspondence for the direction of the change would be +1, since the direction of the movement is the same throughout. If, however, we consider the amount of the change as well as its direction, the Degree of Correspondence for the first series is +.65, for the second is +.12, and for the third is +.21. These varying results show that the amounts of the relative changes are different and not that the Degree of Correspondence is erratic.

Professor Persons's point about the relation of the Degree of Correspondence to the growth element or trend is not clear. Would he have us believe that there is no correspondence between two series because the similarity is imputed to like growth elements? Moreover the Degree of Correspondence can be used to test the correspondence between the trends of two series or the deviations from the trends of the series.

The flippant inquiry as to whether the circulation is increased by drinking alcoholic beverages or vice versa, appears gratuitous. Exactly the same problem of which is cause and which is effect or whether there is any causal relationship would arise if one used the Pearsonian Coefficient of Correlation.

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JAMES D. MAGEE.

REJOINDER.

The point at issue between Dr. Magee and myself concerns the reliability and accuracy of the second of the two methods which he uses to measure the correlation between two series of paired items. He says that the first method gives a "rough" measure of correlation, while the second is "a more accurate form of the degree of correspondenc." (QUARTERLY PUBLICATIONS, June, 1912, pp. 179–180). I agree with his characterization of the first method but hold that the second method not only gives erratic and unreliable results, but that it can not be considered a measure of correlation at all. Our difference is not merely a difference of opinion as to what constitutes perfect correlation.

Dr. Magee describes his "more accurate" form of the Degree of Correspondence as follows: "The percentages of increase or decrease for the corresponding items are computed, and the smaller is divided by the larger. After this number has been computed for each pair of values, the arithmetic mean is taken and the result gives the Degree of Correspondence in the form which considers the amount as well as the direction of the changes" (Money and Prices, p. 7).

Let us apply this method to the following hypothetical series:

YEAR.	A.	B.	C.	D.
1900	100.0	100.0	100.0	100.0
1901	101.0	110.0	101.0	110.0
1902	102.0	121.0	202.0	121.0
1903	103.0	133.1	181.8	119.8
1904	104.0	146.4	163.6	0

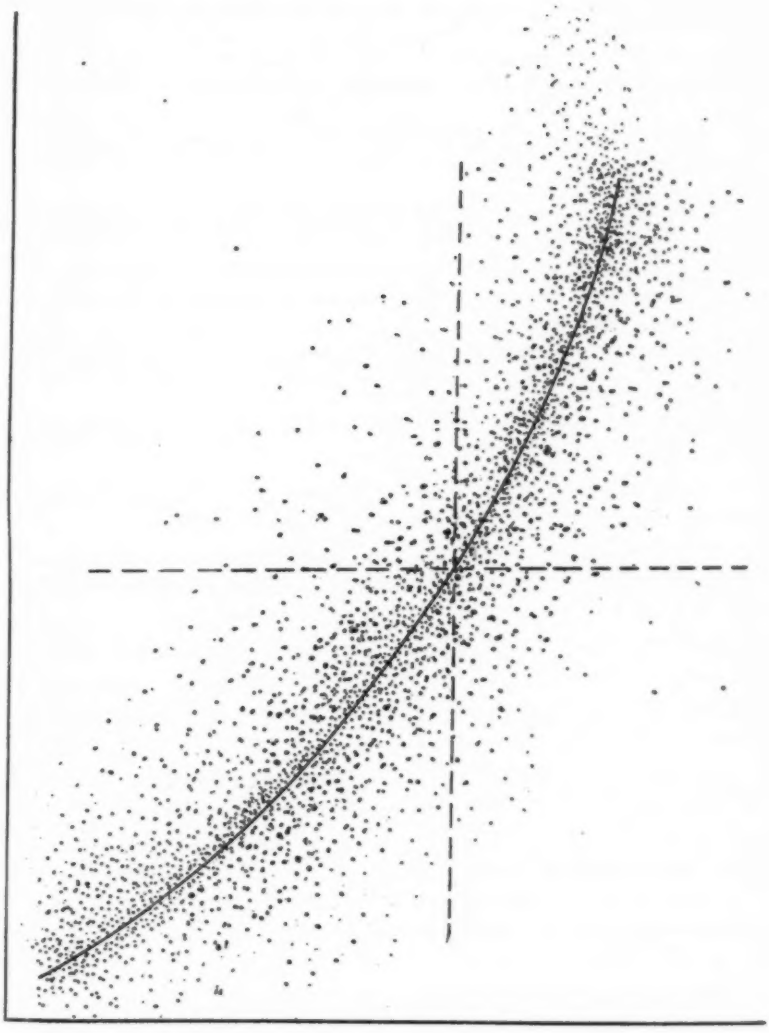
Columns A and B are increasing geometrical progressions, *i. e.*, each item is obtained from the preceding item by adding 1 per cent. and 10 per cent., respectively. The direction of the change is the same throughout the series A and B. The ratio of the percentages of increase is constant and equal to $\frac{1}{10}$, and the arithmetic average which gives the Degree of Correspondence is, therefore, $\frac{1}{10}$. If we should make the computation for series A and another geometrical progression with 2 per cent. as the rate of increase the Degree of Correspondence would be $\frac{1}{2}$. It is evident that two series which move together, each having a constant rate of change, may be built up to give any desired value to the Degree of Correspondence. It appears, then, that the coefficient measures not correlation but average ratio of the rates of change. However, interchanging the rates of change for corresponding items does not affect the result. To illustrate: Column C is constructed by adding 1 per cent., then 100 per cent., and subtracting 10 per cent., then 10 per cent.; column D is constructed by adding 10 per cent., then 10 per cent., and subtracting 1 per cent., then 100 per cent.

from or to each item to get the succeeding item. In each case the ratio of the percentages is $\frac{1}{10}$, making the Degree of Correspondence between series C and D equal to $\frac{1}{10}$, which was the result obtained for series A and B.

It is clear, then, that Dr. Magee uses the word "correlation" to indicate something quite different from the accepted connotation of that term. A. L. Bowley has well expressed the generally accepted meaning of correlation as follows: "When two quantities are so related that the fluctuations in one are in sympathy with the fluctuations of the other, so that an increase or decrease of one is found in connection with an increase or decrease (or inversely) of the other, and the greater the magnitude of the changes in the one, the greater the magnitude of the changes in the other, the quantities are said to be *correlated*" (Elements of Statistics, p. 316). Any coefficient of correlation, therefore, when applied to two time series should measure their *synchronization;* it should be large if fluctuations occur at the same time and if small or large fluctuations of one series occur with relatively small or large fluctuations of the other series. The Pearsonian Coefficient computed in the usual way for series A and B would be very high and positive, while for series C and D it would be low and negative.

The Degree of Correspondence does not give the extent of correlation, but it does give the average ratio of relative change, a distinctly different concept. If we let x represent any item in the A column, y the corresponding item in the B column, and n the number of years from 1900, then $x = 100\ (1.01)^n$ and $y = 100\ (1.10)^n$, giving $\frac{\log x - 2}{\log\ 1.01} = \frac{\log y - 2}{\log\ 1.10}$. The last equation states that for every increase of 1 per cent. in x there is an increase of 10 per cent. in y. It is to be noticed that this is a linear relation between log x and log y so that if the Pearsonian Coefficient of Correlation be computed for the logarithms of the numbers in columns A and B it will be +1, indicating the maximum degree of direct correlation. This, of course, results from the assumption that the corresponding items of the series A and B have an exact mathematical relationship existing between them, in this case the compound interest law. If we should use the corresponding values of columns A and B as coördinates the points thus located would be upon and determine a curve similar to the solid line in the accompanying diagram, the curve being the curve of regression. If, as would be the case when we are dealing with questions of correlation, the items of column A change *approximately* 1 per cent. while the corresponding items of column B change *approximately* 10 per cent., then the plotted points would be located in *proximity* to the curve. The Pearsonian Coefficient of Correlation, computed for the logarithms, gives a measure of the closeness of grouping of the points about the compound interest curve, the curve of regression in this case.

Dr. Magee has confused the idea of correlation (closeness with which the actual corresponding fluctuations obey any law which we may select) and the law which we select for the test. It happens that the law usually selected is the simplest, that is, the question we usually put is this: Does



an increase or decrease of a units in one series correspond to an increase or decrease (or inversely) of b units in the other series? In the case stated our curve of regression becomes a straight line and the Pearsonian Coefficient of Correlation measures the closeness of grouping of points about this straight line (see Yule's Theory of Statistics, p. 202).

Let me call attention to the fact that Dr. Magee's two methods give widely different results when applied to the same pair of series. The Degree of Correspondence for Kemmerer's figures for relative circulation and general prices comes out +0.48 and +0.20, respectively. When there is conflict Dr. Magee abides by the result of the second method, the one which I have criticized.

In conclusion it may be pointed out again that where yearly figures are correlated, such as the indices of prices of nine railway bonds on the New York Stock Exchange and the net deposits of New York Clearing House banks, like growth elements may be the cause of the high Degree of Correspondence obtained; the risk element in the bonds may be steadily decreasing as population increases along the railways and the net deposits may be steadily increasing because of the growth of New York banks due in turn to the growth of New York City.

WARREN M. PERSONS.